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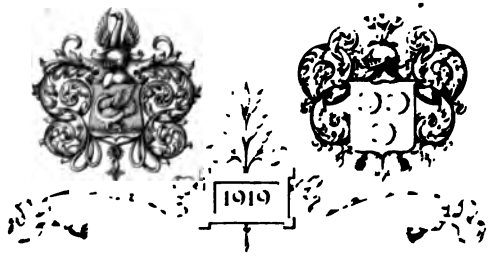

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THE WORKS

OF

FRANCIS BACON.

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THE

WORKS

OF

FRANCIS BACON,

BARON OF VERULAM, VISCOUNT ST. ALBANS, AND
LORD HIGH CHANCELLOR OF ENGLAND.

Collected and Edited

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CENTURY VIII.

Experiment solitary touching veins of medicinal earth.

701. THERE be minerals and fossils in great variety; but of veins of earth medicinal, but few; the chief are, Terra Lemnia,[1] Terra Sigillata communis, and Bolus Arminus; whereof Terra Lemnia is the chief. The virtues of them are, for curing of wounds, stanching of blood, stopping of fluxes and rheums, and arresting the spreading of poison, infection, and putrefaction: and they have of all other simples the perfectest and purest quality of drying, with little or no mixture of any other quality. Yet it is true that the Bole-Arminic is the most cold of them, and that Terra Lemnia is the most hot; for which cause the island Lemnos, where it is digged, was in the old fabulous ages consecrated to Vulcan.

Experiment solitary touching the growth of spunges.

702. About the bottom of the Straits[2] are gathered great quantities of spunges, which are gathered from

[1] See, for some account of Terra Lemnia, Sandys's Travels, p. 18. (7th edition).

[2] That is, the Hellespont. See Sandys, p. 14.

the sides of rocks, being as it were a large but tough moss. It is the more to be noted, because that there be but few substances, plant-like, that grow deep within the sea; for they are gathered sometimes fifteen fathom deep: and when they are laid on shore, they seem to be of great bulk; but crushed together, will be transported in a very small room.

Experiment solitary touching sea-fish put in fresh waters.

703. It seemeth that fish that are used to the salt water, do nevertheless delight more in fresh. We see that salmons and smelts love to get into rivers, though it be against the stream. At the haven of Constantinople you shall have great quantities of fish that come from the Euxine Sea; that when they come into the fresh water, do inebriate and turn up their bellies, so as you may take them with your hand.[1] I doubt there hath not been sufficient experiment made of putting sea-fish into fresh-water ponds and pools. It is a thing of great use and pleasure; for so you may have them new at some good distance from the sea: and besides,

[1] Sandys, p. 23. Modern experience has confirmed what Sandys here relates; but there is no reason to suppose that the fish have any enjoyment in the state of half insensibility which the change to fresh water produces. The cause is probably to be sought in what appears *à priori* to be certain, — namely, the rapid absorption through the gills of fresh water. All the conditions appear to be present by which absorption by endosmosis is occasioned. The periodical migrations from salt to fresh water, and *vice versa*, of certain kinds of fish may perhaps be connected with a change in the composition of the blood, determining endosmosis or exosmosis through the gills, and consequently rendering the fish uneasy in its actual position.

Has it ever been suggested that the persevering way in which salmon ascend rapid streams may result from the unequal velocity of the water at different depths? The consequence of this variation would be a sensation of greater pressure against the lower part of the body than on the upper; which under certain circumstances may be agreeable.

it may be, the fish will eat the pleasanter, and may fall to breed. And it is said, that Colchester oysters, which are put into pits where the sea goeth and cometh, (but yet so that there is a fresh water coming also to them when the sea voideth,) become by that means fatter and more grown.

Experiment solitary touching attraction by similitude of substance.

704. The Turkish bow giveth a very forcible shoot; insomuch as it hath been known that the arrow hath pierced a steel target, or a piece of brass of two inches thick: but that which is more strange, the arrow, if it be headed with wood, hath been known to pierce through a piece of wood of eight inches thick.[1] And it is certain that we had in use at one time, for sea-fight, short arrows, which they called sprights, without any other heads, save wood sharpened; which were discharged out of muskets, and would pierce through the sides of ships where a bullet would not pierce. But this dependeth upon one of the greatest secrets in all nature; which is, that similitude of substance will cause attraction, where the body is wholly freed from the motion of gravity: for if that were taken away, lead would draw lead, and gold would draw gold, and iron would draw iron, without the help of the loadstone. But this same motion of weight or gravity (which is a mere motion of matter, and hath no affinity with the form or kind) doth kill the other motion, except itself be killed by a violent motion; as in these instances of arrows; for then the motion of attraction by similitude of substance be-

[1] Sandys, p. 50.

ginneth to shew itself. But we shall handle this point of nature fully in due place.

Experiment solitary touching certain drinks in Turkey.

705. They have in Turkey and the East certain confections, which they call servets, which are like to candied conserves, and are made of sugar and lemons, or sugar and citrons, or sugar and violets, and some other flowers; and some mixture of amber for the more delicate persons: and those they dissolve in water, and thereof make their drink, because they are forbidden wine by their law.[1] But I do much marvel that no Englishman, or Dutchman, or German, doth set up brewing in Constantinople; considering they have such quantity of barley. For as for the general sort of men, frugality may be the cause of drinking water; for that it is no small saving to pay nothing for one's drink: but the better sort might well be at the cost. And yet I wonder the less at it, because I see France, Italy, or Spain, have not taken into use beer or ale: which (perhaps) if they did, would better both their healths and their complexions. It is likely it would be matter of great gain to any that should begin it in Turkey.

Experiments in consort touching sweat.[2]

706. In bathing in hot water, sweat nevertheless cometh not in the parts under the water. The cause is: first, for that sweat is a kind of colliquation, and

[1] Sandys, p. 51. He like Bacon suggests the establishment of breweries at Constantinople.

[2] For the statements in this and the next three paragraphs, see Arist. Prob. ii. 2, 3, 4. 16, and 23.

that kind of colliquation is not made either by an over-dry heat, or an over-moist heat: for over-moisture doth somewhat extinguish the heat; as we see that even hot water quencheth fire; and over-dry heat shutteth the pores: and therefore men will sooner sweat covered before the sun or fire, than if they stood naked: and earthen bottles filled with hot water do provoke, in bed, a sweat more daintily than brick-bats hot. Secondly, hot water doth cause evaporation from the skin; so as it spendeth the matter in those parts under the water, before it issueth in sweat. Again, sweat cometh more plentifully, if the heat be increased by degrees, than if it be greatest at first, or equal. The cause is, for that the pores are better opened by a gentle heat than by a more violent; and by their opening the sweat issueth more abundantly. And therefore physicians may do well, when they provoke sweat in bed by bottles with a decoction of sudorific herbs in hot water, to make two degrees of heat in the bottles; and to lay in the bed the less heated first, and after half an hour, the more heated.

707. Sweat is salt in taste; the cause is, for that that part of the nourishment which is fresh and sweet, turneth into blood and flesh; and the sweat is only that part which is separate and excerned. Blood also raw hath some saltness, more than flesh; because the assimilation into flesh is not without a little and subtile excretion from the blood.

708. Sweat cometh forth more out of the upper parts of the body than the lower; the reason is, because those parts are more replenished with spirits; and the spirits are they that put forth sweat: besides, they are less fleshy, and sweat issueth (chiefly) out of

the parts that are less fleshy, and more dry; as the forehead and breast.

709. Men sweat more in sleep than waking; and yet sleep doth rather stay other fluxions, than cause them; as rheums, looseness of the body, &c. The cause is, for that in sleep the heat and spirits do naturally move inwards, and there rest. But when they are collected once within, the heat becometh more violent and irritate; and thereby expelleth sweat.

710. Cold sweats are (many times) mortal, and near death; and always ill, and suspected: as in great fears, hypochondriacal passions, &c. The cause is, for that cold sweats come by a relaxation or forsaking of the spirits, whereby the moisture of the body, which heat did keep firm in the parts, severeth and issueth out.

711. In those diseases which cannot be discharged by sweat, sweat is ill, and rather to be stayed; as in diseases of the lungs, and fluxes of the belly: but in those diseases which are expelled by sweat, it easeth and lighteneth; as in agues, pestilences, &c. The cause is, for that sweat in the latter sort is partly critical, and sendeth forth the matter that offendeth; but in the former, it either proceedeth from the labour of the spirits, which sheweth them oppressed; or from motion of consent, when nature, not able to expel the disease where it is seated, moveth to an expulsion indifferent over all the body.

Experiment solitary touching the glow-worm.

712. The nature of the glow-worm is hitherto not well observed. Thus much we see; that they breed

chiefly in the hottest months of summer; and that they breed not in champaign, but in bushes and hedges. Whereby it may be conceived that the spirit of them is very fine, and not to be refined but by summer heats: and again, that by reason of the fineness it doth easily exhale. In Italy, and the hotter countries, there is a fly they call *lucciole*, that shineth as the glow-worm doth; and it may be is the flying glow-worm. But that fly is chiefly upon fens and marshes. But yet the two former observations hold: for they are not seen but in the heat of summer; and sedge, or other green of the fens, give as good shade as bushes. It may be the glow-worms of the cold countries ripen not so far as to be winged.

Experiments in consort touching the impressions which the passions of the mind make upon the body.

713. The passions of the mind work upon the body the impressions following. Fear causeth paleness, trembling, the standing of the hair upright, starting, and skriching. The paleness is caused, for that the blood runneth inward to succour the heart. The trembling is caused, for that through the flight of the spirits inward, the outward parts are destituted, and not sustained. Standing upright of the hair is caused, for that by shutting of the pores of the skin, the hair that lieth aslope must needs rise. Starting is both an apprehension of the thing feared, (and in that kind it is a motion of shrinking,) and likewise an inquisition, in the beginning, what the matter should be, (and in that kind it is a motion of erection); and therefore when a man would listen suddenly to any thing, he starteth; for the starting is an erection of the spirits

to attend. Skriching is an appetite of expelling that which suddenly striketh the spirits: for it must be noted that many motions, though they be unprofitable to expel that which hurteth, yet they are offers of nature, and cause motions by consent; as in groaning or crying upon pain.

714. Grief and pain cause sighing, sobbing, groaning, screaming and roaring, tears, distorting of the face, grinding of the teeth, sweating. Sighing is caused by the drawing in of a greater quantity of breath to refresh the heart that laboureth; like a great draught when one is thirsty. Sobbing is the same thing stronger. Groaning, and screaming, and roaring, are caused by an appetite of expulsion, as hath been said: for when the spirits cannot expel the thing that hurteth, in their strife to do it, by motion of consent they expel the voice. And this is when the spirits yield, and give over to resist: for if one do constantly resist pain, he will not groan. Tears are caused by a contraction of the spirits of the brain; which contraction by consequence astringeth the moisture of the brain, and thereby sendeth tears into the eyes. And this contraction or compression causeth also wringing of the hands; for wringing is a gesture of expression of moisture. The distorting of the face is caused by a contention, first to bear and resist, and then to expel; which maketh the parts knit first, and afterwards open. Grinding of the teeth is caused likewise by a gathering and serring of the spirits together to resist; which maketh the teeth also to set hard one against another. Sweating is also a compound motion, by the labour of the spirits first to resist, and then to expel.

715. Joy causeth a cheerfulness and vigour in the eyes, singing, leaping, dancing, and sometimes tears. All these are the effects of the dilatation and coming forth of the spirits into the outward parts; which maketh them more lively and stirring. We know it hath been seen that excessive sudden joy hath caused present death, while the spirits did spread so much as they could not retire again. As for tears, they are the effects of compression of the moisture of the brain, upon dilatation of the spirits. For compression of the spirits worketh an expression of the moisture of the brain by consent, as hath been said in grief. But then in joy, it worketh it diversely; viz. by propulsion of the moisture, when the spirits dilate and occupy more room.

716. Anger causeth paleness in some, and the going and coming of the colour in others: also trembling in some: swelling, foaming at the mouth, stamping, bending of the fist. Paleness, and going and coming of the colour, are caused by the burning of the spirits about the heart; which, to refresh themselves, call in more spirits from the outward parts. And if the paleness be alone, without sending forth the colour again, it is commonly joined with some fear; but in many there is no paleness at all, but contrariwise redness about the cheeks and gills; which is by the sending forth of the spirits in an appetite to revenge. Trembling in anger is likewise by a calling in of the spirits; and is commonly when anger is joined with fear. Swelling is caused, both by a dilatation of the spirits by over-heating, and by a liquefaction or boiling of the humours thereupon. Foaming at the mouth is from the same cause, being an ebullition. Stamping, and bending

of the fist, are caused by an imagination of the act of revenge.

717. Light displeasure or dislike causeth shaking of the head, frowning, and knitting of the brows. These effects arise from the same causes that trembling and horror do; namely, from the retiring of the spirits, but in a less degree. For the shaking of the head is but a slow and definite trembling; and is a gesture of slight refusal; and we see also that a dislike causeth (often) that gesture of the hand which we use when we refuse a thing, or warn it away. The frowning and knitting of the brows is a gathering or serring of the spirits, to resist in some measure. And we see also this knitting of the brows will follow upon earnest studying or cogitation of any thing, though it be without dislike.

718. Shame causeth blushing, and casting down of the eyes. Blushing is the resort of blood to the face; which in the passion of shame is the part that labours most. And although the blushing will be seen in the whole breast if it be naked, yet that is but in passage to the face. As for the casting down of the eyes, it proceedeth of the reverence a man beareth to other men; whereby, when he is ashamed, he cannot endure to look firmly upon others: and we see that blushing and the casting down of the eyes both, are more when we come before many; *ore Pompeii quid mollius? nunquam non coram pluribus erubuit:* [1] and likewise when we come before great or reverend persons.

719. Pity causeth sometimes tears; and a flexion or cast of the eye aside. Tears come from the same cause that they do in grief: for pity is but grief in

[1] Seneca, Ep. 11.

another's behalf. The cast of the eye is a gesture of aversion, or lothness to behold the object of pity.

720. Wonder causeth astonishment, or an immoveable posture of the body; casting up of the eyes to heaven; and lifting up of the hands. For astonishment, it is caused by the fixing of the mind upon one object of cogitation, whereby it doth not spatiate and transcur, as it useth; for in wonder the spirits fly not, as in fear; but only settle, and are made less apt to move. As for the casting up of the eyes and lifting up of the hands, it is a kind of appeal to the Deity; which is the author, by power and providence, of strange wonders.

721. Laughing causeth a dilatation of the mouth and lips; a continued expulsion of the breath, with the loud noise, which maketh the interjection of laughing; shaking of the breast and sides; running of the eyes with water, if it be violent and continued. Wherein first it is to be understood, that laughing is scarce (properly) a passion, but hath his source from the intellect; for in laughing there ever precedeth a conceit of somewhat ridiculous; and therefore it is proper to man. Secondly, that the cause of laughing is but a light touch of the spirits, and not so deep an impression as in other passions. And therefore (that which hath no affinity with the passions of the mind) it is moved, and that in great vehemency, only by tickling some parts of the body: and we see that men even in a grieved state of mind, yet cannot sometimes forbear laughing. Thirdly, it is ever joined with some degree of delight: and therefore exhilaration hath some affinity with joy, though it be a much lighter motion: *res*

severa est verum gaudium.[1] Fourthly, that the object of it is deformity, absurdity, shrewd turns, and the like. Now to speak of the causes of the effects before mentioned, whereunto these general notes give some light. For the dilatation of the mouth and lips, continued expulsion of the breath and voice, and shaking of the breast and sides, they proceed (all) from the dilatation of the spirits; especially being sudden. So likewise, the running of the eyes with water (as hath been formerly touched, where we spake of the tears of joy and grief) is an effect of dilatation of the spirits. And for suddenness, it is a great part of the matter: for we see, that any shrewd turn that lighteth upon another, or any deformity, &c. moveth laughter in the instant; which after a little time it doth not. So we cannot laugh at anything after it is stale, but whilst it is new: and even in tickling, if you tickle the sides and give warning, or give a hard or continued touch, it doth not move laughter so much.

722. Lust causeth a flagrancy in the eyes; and priapism. The cause of both these is, for that in lust the sight and the touch are the things desired; and therefore the spirits resort to those parts which are most affected. And note well in general, (for that great use may be made of the observation,) that evermore the spirits, in all passions, resort most to the parts that labour most, or are most affected. As in the last which hath been mentioned, they resort to the eyes and venereous parts: in fear and anger to the heart: in shame to the face: and in light dislikes to the head.

[1] Seneca, Ep. 23.

Experiments in consort touching drunkenness.

723. It hath been observed by the ancients, and is yet believed, that the sperm of drunken men is unfruitful.[1] The cause is, for that it is over-moistened, and wanteth spissitude: and we have a merry saying, that they that go drunk to bed get daughters.

724. Drunken men are taken with a plain defect or destitution in voluntary motion. They reel; they tremble; they cannot stand, nor speak strongly. The cause is, for that the spirits of the wine oppress the spirits animal, and occupate part of the place where they are; and so make them weak to move. And therefore drunken men are apt to fall asleep: and opiates and stupefactives (as poppy, henbane, hemlock, &c.) induce a kind of drunkenness, by the grossness of their vapour; as wine doth by the quantity of the vapour. Besides, they rob the spirits animal of their matter, whereby they are nourished: for the spirits of the wine prey upon it as well as they: and so they make the spirits less supple and apt to move.

725. Drunken men imagine every thing turneth round; they imagine also that things come upon them; they see not well things afar off; those things that they see near hand they see out of their place; and (sometimes) they see things double. The cause of the imagination that things turn round is, for that the spirits themselves turn, being compressed by the vapour of the wine (for any liquid body upon compression turneth, as we see in water); and it is all one to the sight, whether the visual spirits move, or

[1] For this and most of the statements in the next three paragraphs, see Arist. Prob. iii. 4, 5, 9, 10, and 12.

the object moveth, or the medium moveth. And we see that long turning round breedeth the same imagination. The cause of the imagination that things come upon them is, for that the spirits visual themselves draw back; which maketh the object seem to come on; and besides, when they see things turn round and move, fear maketh them think they come upon them. The cause that they cannot see things afar off, is the weakness of the spirits; for in every megrim or vertigo there is an obtenebration joined with a semblance of turning round; which we see also in the lighter sort of swoonings. The cause of seeing things out of their place, is the refraction of the spirits visual; for the vapour is an unequal medium; and it is as the sight of things out of place in water. The cause of seeing things double, is the swift and unquiet motion of the spirits (being oppressed) to and fro; for (as was said before) the motion of the spirits visual, and the motion of the object, make the same appearances: and for the swift motion of the object, we see that if you fillip a lute-string, it sheweth double or treble.

726. Men are sooner drunk with small draughts than with great. And again, wine sugared inebriateth less than wine pure. The cause of the former is, for that the wine descendeth not so fast to the bottom of the stomach, but maketh longer stay in the upper part of the stomach, and sendeth vapours faster to the head; and therefore inebriateth sooner. And for the same reason, sops in wine (quantity for quantity) inebriate more than wine of itself. The cause of the latter is, for that the sugar doth inspissate the spirits of the wine, and maketh them

not so easy to resolve into vapour. Nay further, it is thought to be some remedy against inebriating, if wine sugared be taken after wine pure. And the same effect is wrought either by oil or milk, taken upon much drinking.

Experiment solitary touching the help or hurt of wine, though moderately used.

727. The use of wine in dry and consumed bodies is hurtful; in moist and full bodies it is good. The cause is, for that the spirits of the wine do prey upon the dew or radical moisture (as they term it) of the body, and so deceive the animal spirits. But where there is moisture enough, or superfluous, there wine helpeth to digest and desiccate the moisture.

Experiment solitary touching caterpillars.

728. The caterpillar is one of the most general of worms, and breedeth of dew and leaves; for we see infinite number of caterpillars which breed upon trees and hedges, by which the leaves of the trees or hedges are in great part consumed; as well by their breeding out of the leaf, as by their feeding upon the leaf. They breed in the spring chiefly, because then there is both dew and leaf. And they breed commonly when the east winds have much blown; the cause whereof is, the dryness of that wind; for to all vivification upon putrefaction, it is requisite the matter be not too moist: and therefore we see they have cobwebs about them, which is a sign of a slimy dryness; as we see upon the ground, whereupon, by dew and sun, cobwebs breed all over. We see also the green caterpillar breedeth in the inward parts of roses, especially

not blown, where the dew sticketh; but especially caterpillars, both the greatest and the most, breed upon cabbages, which have a fat leaf, and apt to putrefy. The caterpillar, towards the end of summer, waxeth volatile, and turneth to a butterfly, or perhaps some other fly. There is a caterpillar that hath a fur or down upon him, and seemeth to have affinity with the silk-worm.

Experiment solitary touching the flies cantharides.

729. The flies cantharides are bred of a worm or caterpillar, but peculiar to certain fruit-trees; as are the fig-tree, the pine-tree, and the wild briar; all which bear sweet fruit, and fruit that hath a kind of secret biting or sharpness: for the fig hath a milk in it that is sweet and corrosive; the pine-apple hath a kernel that is strong and abstersive: the fruit of the briar is said to make children, or those that eat them, scabbed. And therefore no marvel though cantharides have such a corrosive and cauterising quality;[1] for there is not any other of the insecta, but is bred of a duller matter. The body of the cantharides is bright coloured; and it may be, that the delicate coloured dragon-flies may have likewise some corrosive quality.

Experiments in consort touching lassitude.

730. Lassitude is remedied by bathing, or anointing

[1] All the species of the genus Cantharis, if not all the family of which this genus is the type, appear to have more or less the power of irritating the skin. The one commonly employed, namely Cantharis vesicatoria, seems to be preferred chiefly because on account of its gregarious habits it is more easily obtained. That it is only found on fruit-trees is an error. It is worth remarking, that by pine-apple Bacon means the cone of a pine. The name was transferred to the fruit of the Anana, in consequence of the resemblance the latter bears to a fir-cone.

with oil and warm water.[1] The cause is, for that all lassitude is a kind of contusion and compression of the parts; and bathing and anointing give a relaxation or emollition; and the mixture of oil and water is better than either of them alone; because water entereth better into the pores, and oil after entry softeneth better. It is found also, that the taking of tobacco doth help and discharge lassitude. The reason whereof is, partly because by cheering or comforting of the spirits, it openeth the parts compressed or contused; and chiefly because it refresheth the spirits by the opiate virtue thereof, and so dischargeth weariness; as sleep likewise doth.

731. In going up a hill, the knees will be most weary; in going down a hill, the thighs.[2] The cause is, for that in the lift of the feet, when a man goeth up the hill, the weight of the body beareth most upon the knees; and in going down the hill, upon the thighs.

Experiment solitary touching the casting of the skin and shell in some creatures.

732. The casting of the skin is by the ancients compared to the breaking of the secundine, or caul;[3]

[1] Arist. Prob. v. 6. So Pindar, Nem. iv.:

Ἄριστος εὐφροσύνα
πόνων κεκριμένων
ἰατρός· αἱ δὲ σοφαὶ
Μοισᾶν θυγατέρες ἀοιδαὶ
θέλξαν νιν ἁπτόμεναι.
Οὐδὲ θερμὸν ὕδωρ τόσον
γε μαλθακὰ τεύχει
γυῖα, τόσσον εὐλογία φόρ-
μιγγι συνάορος.

[2] Id. ib. v. 19.

[3] Arist. Hist. Anim. viii. 17.

but not rightly: for that were to make every casting of the skin a new birth: and besides, the secundine is but a general cover, not shaped according to the parts; but the skin is shaped according to the parts. The creatures that cast their skin are, the snake, the viper, the grasshopper, the lizard, the silk-worm, &c. Those that cast their shell are, the lobster, the crab, the crafish, the hodmandod[1] or dodman, the tortoise, &c. The old skins are found, but the old shells never: so as it is like they scale off and crumble away by degrees. And they are known by the extreme tenderness and softness of the new shell, and sometimes by the freshness of the colour of it. The cause of the casting of skin and shell should seem to be, the great quantity of matter in those creatures that is fit to make skin or shell; and again, the looseness of the skin or shell, that sticketh not close to the flesh. For it is certain that it is the new skin or shell that putteth off the old: so we see that in deer it is the young horn that putteth off the old; and in birds, the young feathers put off the old: and so birds that have much matter for their beak, cast their beaks; the new beak putting off the old.

[1] Shell snail. But of course neither they nor tortoises change their shells. It would be endless to point out all similar inaccuracies. Thus, a little further on, it is said that in deer the new horn puts off the old, whereas it is quite clear that the growth of the new horn does not begin until the old one is shed; it goes on, in fact, under the skin which some time afterwards forms over what may be called the stump. This is sufficiently obvious; but there is probably an equal error, though not so easily detected, in what is said with respect to feathers. The truth is, that the habit of close observation of common phenomena does not appear to have been much developed by Bacon's way of life.

Experiments in consort touching the postures of the body.[1]

733. Lying not erect but hollow, which is in the making of the bed, or with the legs gathered up, which is in the posture of the body, is the more wholesome. The reason is, the better comforting of the stomach, which is by that less pensile: and we see that in weak stomachs, the laying up of the legs high, and the knees almost to the mouth, helpeth and comforteth. We see also that galley-slaves, notwithstanding their misery otherwise, are commonly fat and fleshy; and the reason is, because the stomach is supported somewhat in sitting, and is pensile in standing or going. And therefore, for prolongation of life, it is good to choose those exercises where the limbs move more than the stomach and belly; as in rowing, and in sawing being set.

734. Megrims and giddiness are rather when we rise after long sitting, than while we sit. The cause is, for that the vapours, which were gathered by sitting, by the sudden motion fly more up into the head.

735. Leaning long upon any part maketh it numb, and, as we call it, asleep. The cause is, for that the compression of the part suffereth not the spirits to have free access; and therefore when we come out of it, we feel a stinging or pricking; which is the re-entrance of the spirits.

Experiment solitary touching pestilential years.

736. It hath been noted that those years are pestilential and unwholesome, when there are great numbers of frogs,[2] flies, locusts, &c. The cause is plain; for

[1] Compare Arist. Prob. vi. 3, 4, and 6.

[2] Arist. Prob. i. 22.

that those creatures being engendered of putrefaction, when they abound, shew a general disposition of the year, and constitution of the air, to diseases of putrefaction. And the same prognostic (as hath been said before) holdeth, if you find worms in oak-apples: for the constitution of the air appeareth more subtilly in any of these things, than to the sense of man.

Experiment solitary touching the prognostics of hard winters.

737. It is an observation amongst country people, that years of store of haws and heps do commonly portend cold winters; and they ascribe it to God's providence, that (as the Scripture saith) reacheth even to the falling of a sparrow; and much more is like to reach to the preservation of birds in such seasons. The natural cause also may be the want of heat, and abundance of moisture, in the summer precedent; which putteth forth those fruits, and must needs leave great quantity of cold vapours not dissipate; which causeth the cold of the winter following.

Experiment solitary touching medicines that condense and relieve the spirits.

738. They have in Turkey a drink called *coffa*,[1] made of a berry of the same name, as black as soot,

[1] Sandys, p. 52. The use of coffee was, when Bacon wrote, of comparatively recent introduction at Constantinople. According to Abd el Kadir ibn Mahommed (ap. Silvestre de Sacy, Chrestomathie Arabe), who wrote in the 16th century, it has been used from all antiquity in Abyssinia, and passed from thence into Aden about the beginning of the 14th century. From Aden it spread gradually over the Mahommedan world, and reached Constantinople about the middle of the 16th century. I believe the first scientific description of the coffee plant is that given by Jussieu, in the Memoirs of the Academy of Sciences for 1713.

and of a strong scent, but not aromatical; which they take, beaten into powder, in water, as hot as they can drink it: and they take it, and sit at it in their coffa-houses, which are like our taverns. This drink comforteth the brain and heart, and helpeth digestion. Certainly this berry coffa, the root and leaf betel, the leaf tobacco, and the tear of poppy (opium), of which the Turks are great takers (supposing it expelleth all fear), do all condense the spirits, and make them strong and aleger. But it seemeth they were taken after several manners; for coffa and opium are taken down, tobacco but in smoke, and betel is but champed in the mouth with a little lime. It is like there are more of them, if they were well found out, and well corrected. *Quære* of henbane-seed; of mandrake; of saffron, root and flower; of folium indum; of ambergrise; of the Assyrian amomum, if it may be had; and of the scarlet powder which they call *kermez;* and (generally) of all such things as do inebriate and provoke sleep. Note that tobacco is not taken in root or seed, which are more forcible ever than leaves.

Experiment solitary touching paintings of the body.

739. The Turks have a black powder, made of a mineral called *alcohole*, which with a fine long pencil they lay under their eye-lids; which doth colour them black; whereby the white of the eye is set off more white.[1] With the same powder they colour also the hairs of their eye-lids, and of their eye-brows, which they draw into embowed arches. You shall find that Xenophon maketh mention, that the Medes used to paint their eyes. The Turks use with the same tinct-

[1] Sandys, p. 53.

ure to colour the hair of their heads and beards black. And divers with us that are grown grey, and yet would appear young, find means to make their hair black, by combing it (as they say) with a leaden comb, or the like. As for the Chineses, who are of an ill complexion (being olivaster), they paint their cheeks scarlet, especially their king and grandes.[1] Generally, barbarous people, that go naked, do not only paint themselves, but they pounce and raze their skin, that the painting may not be taken forth; and make it into works. So do the West Indians; and so did the ancient Picts and Britons; so that it seemeth men would have the colours of birds' feathers, if they could tell how; or at least they will have gay skins instead of gay clothes.

Experiment solitary touching the use of bathing and anointing.

740. It is strange that the use of bathing, as a part of diet, is left. With the Romans and Grecians it was as usual as eating or sleeping; and so is it amongst the Turks at this day: whereas with us it remaineth but as a part of physic. I am of opinion, that the use of it, as it was with the Romans, was hurtful to health;

[1] I do not know where Bacon found this. It is not mentioned, I think, by modern travellers. The Chinese call us red men. It appears from Pliny, xxxiii. 36., that in early times it was usual in Rome to colour the image of Jupiter red, or at least its face, and to smear in a similar way the bodies of those who triumphed. O. K. Müller connects the two things, regarding the triumph as a kind of Apotheosis.

[I have retained the original spelling of *grandes*; the double *e*, which was no doubt introduced merely to mark the word as a dissyllable, has led to the misplacing of the accent. The Spanish *grande* would not have changed into the English *grande'e*, as we now pronounce it, except through ignorance. — *J. S.*]

for that it made the body soft, and easy to waste. For the Turks it is more proper, because that their drinking water, and feeding upon rice, and other food of small nourishment, maketh their bodies so solid and hard, as you need not fear that bathing should make them frothy. Besides the Turks are great sitters, and seldom walk, whereby they sweat less and need bathing more. But yet certain it is that bathing, and especially anointing, may be so used as it may be a great help to health and prolongation of life. But hereof we shall speak in due place, when we come to handle experiments medicinal.

Experiment solitary touching chamoletting of paper.

741. The Turks have a pretty art of chamoletting of paper, which is not with us in use.[1] They take divers oiled colours, and put them severally (in drops) upon water; and stir the water lightly; and then wet their paper (being of some thickness) with it; and the paper will be waved and veined, like chamolet or marble.

Experiment solitary touching cuttle-ink.

742. It is somewhat strange, that the blood of all birds and beasts and fishes should be of a red colour, and only the blood of the cuttle should be as black as ink.[2] A man would think, that the cause should be

[1] Sandys, p. 56. Beckmann, in speaking of the invention of this art, mentions the passage in the text; but not being aware of the source of Bacon's information, asserts that notwithstanding the name Turkish paper, by which what is now called marbled paper used to be known, the art of making it was discovered in Germany.

[2] That the black fluid of the cuttle-fish is not blood was remarked by Aristotle, *Hist. An.* i. 4. The blood of the Invertebrata is most frequently colourless. It is in some cases red, and often of other colours. The house

the high concoction of that blood; for we see in ordinary puddings that the boiling turneth the blood to be black; and the cuttle is accounted a delicate meat, and is much in request.

Experiment solitary touching increase of weight in earth.

743. It is reported of credit, that if you take earth from land adjoining to the river of Nile, and preserve it in that manner that it neither come to be wet nor wasted, and weigh it daily, it will not alter weight until the seventeenth of June, which is the day when the river beginneth to rise: and then it will grow more and more ponderous, till the river cometh to his height.[1] Which if it be true, it cannot be caused but by the air, which then beginneth to condense; and so turneth within that small mould into a degree of moisture, which produceth weight. So it hath been observed that tobacco, cut and weighed, and then dried by the fire, loseth weight; and after being laid in the open air, recovereth weight again. And it should seem that as soon as ever the river beginneth to increase, the whole body of the air thereabouts suffereth a change: for (that which is more strange) it is credibly affirmed, that upon that very day when the river first riseth, great plagues in Cairo use suddenly to break up.

Experiments in consort touching sleep.

744. Those that are very cold, and especially in their feet, cannot get to sleep.[2] The cause may be, for that in sleep is required a free respiration, which

fly is commonly believed to have red blood, but the red stain produced when a fly is crushed is in reality due to the pigment of the eyes.

[1] Sandys, p. 77.

[2] Arist. Prob. viii. 2.

cold doth shut in and hinder: for we see that in great colds one can scarce draw his breath. Another cause may be, for that cold calleth the spirits to succour; and therefore they cannot so well close and go together in the head; which is ever requisite to sleep. And for the same cause, pain and noise hinder sleep; and darkness (contrariwise) furthereth sleep.

745. Some noises (whereof we spake in the hundred and twelfth experiment) help sleep; as the blowing of the wind, the trickling of water, humming of bees, soft singing, reading, &c. The cause is, for that they move in the spirits a gentle attention; and whatsoever moveth attention, without too much labour, stilleth the natural and discursive motion of the spirits.

746. Sleep nourisheth or at least preserveth bodies a long time, without other nourishment. Beasts that sleep in winter (as it is noted in wild bears) during their sleep wax very fat, though they eat nothing. Bats have been found in ovens, and other hollow close places, matted one upon another: and therefore it is likely that they sleep in the winter time and eat nothing. *Quære*, whether bees do not sleep all winter, and spare their honey? Butterflies, and other flies, do not only sleep, but lie as dead all winter; and yet with a little heat of sun or fire revive again. A dormouse, both winter and summer, will sleep some days together, and eat nothing.

Experiments in consort touching teeth and hard substances in the bodies of living creatures.

To restore teeth in age, were *magnale naturæ*. It may be thought of. But howsoever the nature

of the teeth deserveth to be inquired of, as well as the other parts of living creatures' bodies.

747. There be five parts in the bodies of living creatures, that are of hard substance; the skull, the teeth, the bones, the horns, and the nails. The greatest quantity of hard substance continued is towards the head. For there is the skull, of one entire bone; there are the teeth; there are the maxillary bones; there is the hard bone that is the instrument of hearing; and thence issue the horns; so that the building of living creatures' bodies is like the building of a timber house; where the walls and other parts have columns and beams, but the roof is, in the better sort of houses, all tile or lead or stone. As for birds, they have three other hard substances proper to them; the bill, which is of the like matter with the teeth; for no birds have teeth: the shell of the egg: and their quills: for as for their spur, it is but a nail. But no living creatures that have shells very hard (as oysters, cockles, mussles, scallops, crabs, lobsters, cra-fish, shrimps, and especially the tortoise,) have bones within them, but only little gristles.[1]

748. Bones, after full growth, continue at a stay; and so doth the skull: horns, in some creatures, are cast and renewed: teeth stand at a stay, except their wearing: as for nails, they grow continually: and bills and beaks will overgrow, and sometimes be cast; as in eagles and parrots.[2]

[1] Here, as in 732., we see that Bacon knew but little of the natural history of the tortoise.

[2] Bones, like the soft parts of the body, are renewed throughout life, and so in many cases are teeth. Cuvier has remarked that the mutual adaptation of teeth and the bones with which they are connected is one of the

749. Most of the hard substances fly to the extremes of the body; as skull, horns, teeth, nails, and beaks: only the bones are more inward, and clad with flesh. As for the entrails, they are all without bones; save that a bone is (sometimes) found in the heart of a stag; and it may be in some other creature.

750. The skull hath brains, as a kind of marrow, within it. The back-bone hath one kind of marrow, which hath an affinity with the brain; and other bones of the body have another.[1] The jaw-bones have no marrow severed, but a little pulp of marrow diffused. Teeth likewise are thought to have a kind of marrow diffused, which causeth the sense and pain; but it is rather sinew: for marrow hath no sense; no more than blood. Horn is alike throughout; and so is the nail.

751. None other of the hard substances have sense, but the teeth; and the teeth have sense, not only of pain, but of cold.

But we will leave the inquiries of other hard substances unto their several places, and now inquire only of the teeth.

752. The teeth are, in men, of three kinds: sharp, as the fore-teeth; broad, as the back-teeth, which we call the molar-teeth, or grinders; and pointed teeth, or canine, which are between both.[2] But there have been some men that have had their teeth undivided, as of one whole bone, with some little mark in the place

most admirable parts of the animal economy; the mode of development of the two structures being wholly dissimilar, teeth growing by secretion, and bones by intus-susception. V. Cuv. *Eloge de Tenon.*

[1] The marrow of bones is, of course, quite of a different nature from either brain or the spinal cord.

[2] This sentence is copied from Aristotle, *De Part. Anim.* iii. 1.

of the division, as Pyrrhus had.[1] Some creatures have over-long or out-growing teeth, which we call fangs, or tusks: as boars, pikes, salmons; and dogs, though less. Some living creatures have teeth against teeth, as men and horses; and some have teeth, especially their master-teeth, indented one within another like saws; as lions; and so again have dogs. Some fishes have divers rows of teeth in the roofs of their mouths; as pikes, salmons, trouts, &c. And many more in salt-waters. Snakes and other serpents have venomous teeth; which are sometimes mistaken for their sting.

753. No beast that hath horns hath upper teeth; and no beast that hath teeth above wanteth them below: but yet if they be of the same kind, it followeth not that if the hard matter goeth not into upper teeth, it will go into horns; nor yet *è converso;* for does, that have no horns, have no upper teeth.[2]

754. Horses have, at three years old, a tooth put forth, which they call the colt's tooth; and at four years' old there cometh the mark-tooth, which hath a hole as big as you may lay a pea[3] within it; and that weareth shorter and shorter every year; till that at eight years' old the tooth is smooth, and the hole gone: and then they say, that *the mark is out of the horse's mouth.*

755. The teeth of men breed first, when the child is about a year and a half old: and then they cast them, and new come about seven years' old. But divers have backward teeth come forth at twenty, yea, some at thirty and forty. *Quære* of the manner of the com-

[1] Plutarch, in Pyrrhus, p. 434.

[2] See Arist. De Part. Anim. iii. 2., and Hist. Animal. ii. 1.

[3] *a pease* in the original. — *J. S.*

ing of them forth. They tell a tale of the old Countess of Desmond, who lived till she was seven score years old, that she did *dentire* twice or thrice; casting her old teeth, and others coming in their place.

756. Teeth are much hurt by sweetmeats; and by painting with mercury; and by things over-hot; and by things over-cold; and by rheums. And the pain of the teeth is one of the sharpest of pains.

757. Concerning teeth, these things are to be considered. 1. The preserving of them. 2. The keeping of them white. 3. The drawing of them with least pain. 4. The staying and easing of the toothache. 5. The binding in of artificial teeth, where teeth have been strucken out. 6. And last of all, that great one of restoring teeth in age. The instances that give any likelihood of restoring teeth in age are, the late coming of teeth in some; and the renewing of the beaks in birds, which are commaterial with teeth. *Quære* therefore more particularly how that cometh. And again, the renewing of horns. But yet that hath not been known to have been provoked by art; therefore let trial be made whether horns may be procured to grow in beasts that are not horned, and how? And whether they may be procured to come larger than usual; as to make an ox or a deer have a greater head of horns? And whether the head of a deer, that by age is more spitted, may be brought again to be more branched? for these trials, and the like, will show, whether by art such hard matter can be called and provoked. It may be tried also whether birds may not have something done to them when they are young, whereby they may be made to have greater or longer bills, or greater and longer talons? And whether children may not

have some wash or something to make their teeth better and stronger? Coral is in use as an help to the teeth of children.

Experiments in consort touching the generation and bearing of living creatures in the womb.

758. Some living creatures generate but at certain seasons of the year; as deer, sheep, wild coneys, &c., and most sorts of birds and fishes: others at any time of the year; as men, and all domestic creatures, as horses, hogs, dogs, cats, &c.[1] The cause of generation at all seasons seemeth to be fulness: for generation is from redundance. This fulness ariseth from two causes: either from the nature of the creature, if it be hot and moist and sanguine; or from plenty of food. For the first, men, horses, dogs, &c. which breed at all seasons, are full of heat and moisture; doves are the fullest of heat and moisture amongst birds, and therefore breed often; the tame dove almost continually. But deer are a melancholy dry creature, as appeareth by their fearfulness, and the hardness of their flesh. Sheep are a cold creature, as appeareth by their mildness, and for that they seldom drink. Most sort of birds are of a dry substance in comparison of beasts. Fishes are cold. For the second cause, fulness of food; men, kine, swine, dogs, &c. feed full; and we see that those creatures which being wild generate seldom, being tame generate often; which is from warmth, and fulness of food. We find that the time of going to rut of deer is in September; for that they need the whole summer's feed and grass, to make them fit for generation. And

[1] Arist. Prob. x. 49.

if rain come early about the middle of September, they go to rut somewhat the sooner; if drought, somewhat the later. So sheep, in respect of their small heat, generate about the same time, or somewhat before. But for the most part, creatures that generate at certain seasons, generate in the spring; as birds and fishes; for that the end of the winter, and the heat and comfort of the spring, prepareth them. There is also another reason why some creatures generate at certain seasons: and that is the relation of their time of bearing to the time of generation; for no creature goeth to generate whilst the female is full; nor whilst she is busy in sitting, or rearing her young. And therefore it is found by experience, that if you take the eggs or young ones out of the nests of birds, they will fall to generate again, three or four times, one after another.

759. Of living creatures, some are longer time in the womb, and some shorter. Women go commonly nine months; the cow and the ewe about six months;[1] does go about nine months; mares eleven months; bitches nine weeks; elephants are said to go two years; for the received tradition of ten years is fabulous. For birds there is double inquiry: the distance between the treading or coupling, and the laying of the egg; and again, between the egg laid, and the disclosing or hatching: and amongst birds there is less diversity of time than amongst other creatures; yet some there is; for the hen sitteth but three weeks; the turkey-hen, goose, and duck, a month: *Quære* of others.[2] The

[1] These statements are very inaccurate. Tessier assigns 282 days in the former case, and 151 in the latter, as mean periods. See *Mém. de l'Ac. des Sciences*, (1817).

[2] The pigeon sits about eighteen days, the swan about thirty-three. The

cause of the great difference of times amongst living creatures, is either from the nature of the kind, or from the constitution of the womb. For the former, those that are longer in coming to their maturity or growth are longer in the womb; as is chiefly seen in men: and so elephants, which are long in the womb, are long time in coming to their full growth. But in most other kinds, the constitution of the womb (that is, the hardness or dryness thereof,) is concurrent with the former cause. For the colt hath about four years of growth; and so the fawn; and so the calf. But whelps, which come to their growth (commonly) within three quarters of a year, are but nine weeks in the womb. As for birds, as there is less diversity amongst them in the time of their bringing forth, so there is less diversity in the time of their growth; most of them coming to their growth within a twelvemonth.

760. Some creatures bring forth many young ones at a burthen: as bitches, hares, coneys, &c. Some (ordinarily) but one; as women, lionesses, &c.[1] This may be caused, either by the quantity of sperm required to the producing one of that kind; which if less be required, may admit greater number; if more, fewer: or by the partitions and cells of the womb, which may sever the sperm.

Experiments in consort touching species visible.

761. There is no doubt but light by refraction will shew greater, as well as things coloured. For like as

turkey-hen about twenty-seven, the duck and goose thirty to thirty-two days. The hen, as Bacon says, about three weeks. See Tessier and F. Cuvier, ubi supra.

[1] Arist. Prob. x. 16.

a shilling in the bottom of the water will shew greater; so will a candle in a lanthorn, in the bottom of the water. I have heard of a practice, that glow-worms in glasses were put in the water to make the fish come. But I am not yet informed whether when a diver diveth, having his eyes open, and swimmeth upon his back; whether (I say) he seeth things in the air greater or less. For it is manifest that when the eye standeth in the finer medium, and the object is in the grosser, things shew greater; but contrariwise, when the eye is placed in the grosser medium, and the object in the finer, how it worketh I know not.

762. It would be well bolted out, whether great refractions may not be made upon reflexions, as well as upon direct beams. For example, we see that, take an empty bason, put an angel of gold, or what you will, into it; then go so far from the bason, till you cannot see the angel, because it is not in a right line; then fill the bason with water; and you shall see it out of his place, because of the reflexion. To proceed therefore, put a looking-glass into a bason of water; I suppose you shall not see the image in a right line, or at equal angles, but aside. I know not whether this experiment may not be extended so as you might see the image, and not the glass; which for beauty and strangeness were a fine proof: for then you should see the image like a spirit in the air. As for example, if there be a cistern or pool of water, you shall place over against it a picture of the devil, or what you will, so as you do not see the water. Then put a looking-glass in the water: now if you can see the devil's picture aside, not seeing the water, it will look like a devil indeed. They have an old tale in Oxford, that

Friar Bacon walked between two steeples: which was thought to be done by glasses, when he walked upon the ground.

Experiments in consort touching impulsion and percussion.

768. A weighty body put into motion is more easily impelled, than at first when it resteth.[1] The cause is partly because motion doth discuss the torpor of solid bodies; which, beside their motion of gravity, have in them a natural appetite not to move at all; and partly because a body that resteth doth get, by the resistance of the body upon which it resteth, a stronger compression of parts than it hath of itself: and therefore needeth more force to be put in motion. For if a weighty body be pensile, and hang but by a thread, the percussion will make an impulsion very near as easily as if it were already in motion.

764. A body over-great or over-small, will not be thrown so far as a body of a middle size:[2] so that (it seemeth) there must be a commensuration or proportion between the body moved and the force, to make it move well. The cause is, because to the impulsion there is requisite the force of the body that moveth, and the resistance of the body that is moved: and if the body be too great, it yieldeth too little; and if it be too small, it resisteth too little.

765. It is common experience, that no weight will press or cut so strong, being laid upon a body, as falling or strucken from above. It may be the air hath some part in furthering the percussion; but the chief cause I take to be, for that the parts of the body

[1] Arist. Mech. Quæst. 32. [2] Id. ib. 35.

moved have, by impulsion or by the motion of gravity continued, a compression in them as well downwards, as they have, when they are thrown or shot through the air, forwards. I conceive also that the quick loose of that motion preventeth the resistance of the body below: and priority of the force always is of great efficacy; as appeareth in infinite instances.

Experiment solitary touching titillation.

766. Tickling is most in the soles of the feet, and under the arm-holes, and on the sides. The cause is, the thinness of the skin in those parts, joined with the rareness of being touched there. For all tickling is a light motion of the spirits, which the thinness of the skin, and suddenness and rareness of touch, do further: for we see a feather, or a rush, drawn along the lip or cheek, doth tickle; whereas a thing more obtuse, or a touch more hard, doth not. And for suddenness, we see no man can tickle himself:[1] we see also that the palm of the hand, though it hath as thin a skin as the other parts mentioned, yet is not ticklish, because it is accustomed to be touched. Tickling also causeth laughter. The cause may be the emission of the spirits, and so of the breath, by a flight from titillation; for upon tickling we see there is ever a starting or shrinking away of the part to avoid it; and we see also, that if you tickle the nostrils with a feather, or straw, it procureth sneezing; which is a sudden emission of the spirits, that do likewise expel the moisture. And tickling is ever painful, and not well endured.

[1] See Arist. *Prob.* xxxv. 2. and 6.; and compare Scaliger, *Exercit. adv. Cardanum*, 317. 5.

Experiment solitary touching the scarcity of rain in Egypt.[1]

767. It is strange, that the river of Nilus overflowing, as it doth, the country of Egypt, there should be nevertheless little or no rain in that country. The cause must be either in the nature of the water, or in the nature of the air, or of both. In the water, it may be ascribed either unto the long race of the water; for swift-running waters vapour not so much as standing waters; or else to the concoction of the water; for waters well concocted vapour not so much as waters raw; no more than waters upon the fire do vapour so much after some time of boiling as at the first. And it is true that the water of Nilus is sweeter than other waters in taste; and it is excellent good for the stone, and hypochondriacal melancholy; which sheweth it is lenifying; and it runneth through a country of a hot climate, and flat, without shade either of woods or hills; whereby the sun must needs have great power to concoct it. As for the air, (from whence I conceive this want of showers cometh chiefly,) the cause must be, for that the air is of itself thin and thirsty; and as soon as ever it getteth any moisture from the water, it imbibeth and dissipateth it in the whole body of the air; and suffereth it not to remain in vapour, whereby it might breed rain.

Experiment solitary touching clarification.

768. It hath been touched in the title of percolations (namely, such as are inwards), that the whites

[1] The substance of this and the next paragraph is taken from Sandys, p. 78.

of eggs and milk do clarify; and it is certain that in Egypt they prepare and clarify the water of Nile, by putting it into great jars of stone, and stirring it about with a few stamped almonds; wherewith they also besmear the mouth of the vessel; and so draw it off, after it hath rested some time. It were good to try this clarifying with almonds in new beer or must, to hasten and perfect the clarifying.

Experiment solitary touching plants without leaves.

769. There be scarce to be found any vegetables that have branches and no leaves, except you allow coral for one. But there is also in the deserts of S. Macario in Egypt, a plant which is long, leafless, brown of colour, and branched like coral, save that it closeth at the top. This being set in water within house, spreadeth and displayeth strangely; and the people thereabout have a superstitious belief, that in the labour of women it helpeth to the easy deliverance.[1]

Experiment solitary touching the materials of glass.

770. The crystalline Venice glass is reported to be a mixture in equal portions of stones brought from Pavia by the river Ticinum, and the ashes of a weed, called by the Arabs *kall*, which is gathered in a desert between Alexandria and Rosetta; and is by the Egyptians used first for fuel; and then they crush the ashes into lumps like a stone, and so sell them to the Venetians for their glass-works.[2]

[1] Sandys, p. 85. The word *long* is, as we see on referring to Sandys, an erratum. It ought to be *low*.

[2] Ib. p. 90.

Experiment solitary touching prohibition of putrefaction, and the long conservation of bodies.

771. It is strange, and well to be noted, how long carcasses have continued uncorrupt, and in their former dimensions; as appeareth in the mummies of Egypt; having lasted, as is conceived, (some of them) three thousand years. It is true, they find means to draw forth the brains, and to take forth the entrails, which are the parts aptest to corrupt. But that is nothing to the wonder: for we see what a soft and corruptible substance the flesh of all the other parts of the body is. But it should seem that, according to our observation and axiom in our hundredth experiment, putrefaction, which we conceive to be so natural a period of bodies, is but an accident; and that matter maketh not that haste to corruption that is conceived. And therefore bodies in shining amber, in quicksilver, in balms (whereof we now speak), in wax, in honey, in gums, and (it may be) in conservatories of snow, &c., are preserved very long. It need not go for repetition, if we resume again that which we said in the aforesaid experiments concerning annihilation; namely, that if you provide against three causes of putrefaction, bodies will not corrupt: the first is, that the air be excluded; for that undermineth the body, and conspireth with the spirit of the body to dissolve it. The second is, that the body adjacent and ambient be not commaterial, but merely heterogeneal towards the body that is to be preserved; for if nothing can be received by the one, nothing can issue from the other; such are quicksilver and white amber, to herbs and flies, and such bodies. The third is, that the body

to be preserved be not of that gross that it may corrupt within itself, although no part of it issue into the body adjacent: and therefore it must be rather thin and small, than of bulk. There is a fourth remedy also; which is, that if the body to be preserved be of bulk, as a corpse is, then the body that incloseth it must have a virtue to draw forth and dry the moisture of the inward body; for else the putrefaction will play within, though nothing issue forth. I remember Livy doth relate, that there were found at a time two coffins of lead in a tomb; whereof the one contained the body of King Numa; it being some four hundred years after his death; and the other, his books of sacred rites and ceremonies, and the discipline of the pontiffs; and that in the coffin that had the body, there was nothing at all to be seen, but a little light cinders about the sides; but in the coffin that had the books, they were found as fresh as if they had been but newly written, being written in parchment, and covered over with watch-candles of wax three or four fold. By this it seemeth that the Romans in Numa's time were not so good embalmers as the Egyptians were; which was the cause that the body was utterly consumed. But I find in Plutarch and others, that when Augustus Cæsar visited the sepulchre of Alexander the Great in Alexandria, he found the body to keep his dimension; but withal, that notwithstanding all the embalming, (which no doubt was of the best,) the body was so tender, as Cæsar, touching but the nose of it, defaced it.[1] Which

[1] This story is not mentioned by Plutarch, nor, so far as I am aware, by any authorities except Suetonius and Dio Cassius. The latter mentions that Augustus broke off a piece of the nose. See Suet. in Aug. ii. 18., and Dio Cassius, li. § 16. The opening of Numa's coffin is described by Livy, xl. 29., who, however, does not say that any cinders were found in it.

maketh me find it very strange, that the Egyptian mummies should be reported to be as hard as stone-pitch;[1] for I find no difference but one, which indeed may be very material, namely that the ancient Egyptian mummies were shrouded in a number of folds of linen, besmeared with gums, in manner of sear-cloth; which it doth not appear was practised upon the body of Alexander.

Experiment solitary touching the abundance of nitre in certain sea-shores.

772. Near the castle of Catie, and by the wells of Assan, in the land of Idumea, a great part of the way you would think the sea were near at hand, though it be a good distance off: and it is nothing but the shining of the nitre upon the sea sands; such abundance of nitre the shores there do put forth.[2]

Experiment solitary touching bodies that are borne up by water.

773. The Dead Sea, which vomiteth up bitumen, is of that crassitude, as living bodies bound hand and foot cast into it have been borne up, and not sunk;[3] which sheweth, that all sinking into water is but an overweight of the body put into the water in respect of the water; so that you may make water so strong and heavy, of quicksilver (perhaps) or the like, as may bear up iron; of which I see no use, but imposture. We see also that all metals except gold, for the same reason, swim upon quicksilver.

[1] Namely, by Sandys, p. 104. [2] Sandys, p. 109.
[3] Id. p. 110.

Experiment solitary touching fuel that consumeth little or nothing.

774. It is reported, that at the foot of a hill near the Mare Mortuum there is a black stone (whereof pilgrims make fires) which burneth like a coal, and diminisheth not; but only waxeth brighter and whiter.[1] That it should do so is not strange: for we see iron red hot burneth, and consumeth not; but the strangeness is, that it should continue any time so; for iron, as soon as it is out of the fire, deadeth straightways. Certainly it were a thing of great use and profit, if you could find out fuel that would burn hot, and yet last long: neither am I altogether incredulous but there may be such candles as they say are made of salamander's wool; being a kind of mineral, which whiteneth also in the burning, and consumeth not. The question is this; flame must be made of somewhat; and commonly it is made of some tangible body which hath weight: but it is not impossible perhaps that it should be made of spirit or vapour in a body, (which spirit or vapour hath no weight,) such as is the matter of ignis fatuus. But then you will say, that that vapour also can last but a short time: to that it may be answered, that by the help of oil, and wax, and other candle-stuff, the flame may continue, and the wick not burn.

Experiment solitary œconomical touching cheap fuel.

775. Sea-coal lasts longer than charcoal; and charcoal of roots, being coaled into great pieces, lasts longer

[1] Sandys, p. 111. But for *brighter* we ought, on the authority of the passage in Sandys, to read *lighter*.

than ordinary charcoal. Turf, and peat, and cow-sheards, are cheap fuels, and last long. Small-coal, or briar-coal poured upon charcoal, make them last longer. Sedge is a cheap fuel to brew or bake with: the rather because it is good for nothing else. Trial would be made of some mixture of sea-coal with earth or chalk; for if that mixture be,[1] as the sea-coal men use it, privily to make the bulk of the coal greater, it is deceit; but if it be used purposely, and be made known, it is saving.

Experiment solitary touching the gathering of wind for freshness.

776. It is at this day in use in Gaza, to couch pot-sheards or vessels of earth in their walls, to gather the wind from the top, and to pass it down in spouts into rooms.[2] It is a device for freshness in great heats: and it is said there are some rooms in Italy and Spain for freshness, and gathering the winds and air, in the heats of summer; but they be but pennings of the winds and enlarging them again, and making them reverberate and go round in circles, rather than this device of spouts in the wall.

Experiment solitary touching the trials of airs.

777. There would be used much diligence in the choice of some bodies and places, (as it were) for the tasting of air; to discover the wholesomeness or unwholesomeness, as well of seasons, as of the seats of dwellings. It is certain that there be some houses, wherein confitures and pies will gather mould more

[1] So in the original. Bacon probably wrote *be used*. — *J. S.*
[2] Sandys, p. 116.

than in others. And I am persuaded that a piece of raw flesh or fish will sooner corrupt in some airs than in others. They be noble experiments that can make this discovery; for they serve for a natural divination of seasons, better than the astronomers can by their figures: and again, they teach men where to choose their dwelling for their better health.

Experiment solitary touching increasing of milk in milch-beasts.

778. There is a kind of stone about Bethlehem, which they grind to powder and put into water whereof cattle drink; which maketh them give more milk.[1] Surely there would be some better trials made of mixtures of water in ponds for cattle, to make them more milch, or to fatten them, or to keep them from murrain. It may be chalk and nitre are of the best.

Experiment solitary touching sand of the nature of glass.

779. It is reported, that in the valley near the mountain Carmel in Judea there is a sand, which of all other hath most affinity with glass;[2] insomuch as other minerals laid in it turn to a glassy substance, without the fire; and again, glass put into it turneth into the mother-sand. The thing is very strange, if it be true: and it is likeliest to be caused by some natural furnace, or heat in the earth: and yet they do not speak of any eruption of flames. It were good to try in glass-works, whether the crude materials of glass, mingled with glass already made, and remolten, do not facilitate the making of glass with less heat.

[1] Sandys, p. 142. [2] Id. p. 159.

Experiment solitary touching the growth of coral.

780. In the sea, upon the south-west of Sicily, much coral is found.[1] It is a submarine plant. It hath no leaves: it brancheth only when it is under water; it is soft, and green of colour; but being brought into the air, it becometh hard and shining red, as we see. It is said also to have a white berry; but we find it not brought over with coral. Belike it is cast away as nothing worth: inquire better of it, for the discovery of the nature of the plant.

Experiment solitary touching the gathering of manna.

781. The manna of Calabria is the best, and in most plenty.[2] They gather it from the leaf of the mulberry-tree; but not of such mulberry-trees as grow in the valleys. And manna falleth upon the leaves by night, as other dews do. It should seem that before those dews come upon trees in the valleys, they dissipate, and cannot hold out. It should seem also, the mulberry-leaf itself hath some coagulating virtue, which inspissateth the dew; for that it is not found upon other trees: and we see by the silkworm, which feedeth upon that leaf, what a dainty smooth juice it hath; and the leaves also (especially of the black mulberry) are somewhat bristly, which may help to preserve the dew. Certainly it were not amiss to observe a little better the dews that fall upon trees, or herbs growing on mountains; for it may be many dews fall, that spend before they come to the valleys. And I suppose that he that would gather the best May-dew for medicine, should gather it from the hills.

[1] *Sandys*, p. 184. [2] Id. p. 195.

Experiment solitary touching the correcting of wine.

782. It is said they have a manner to prepare their Greek wines, to keep them from fuming and inebriating, by adding some sulphur or alum: whereof the one is unctuous, and the other is astringent.[1] And certain it is that those two natures do best repress fumes. This experiment would be transferred unto other wine and strong beer, by putting in some like substances while they work; which may make them both to fume less, and to inflame less.

Experiment solitary touching the materials of wild-fire.

783. It is conceived by some (not improbably) that the reason why wild-fires (whereof the principal ingredient is bitumen) do not quench with water, is, for that the first concretion of bitumen is a mixture of a fiery and watery substance: so is not sulphur. This appeareth, for that in the place near Puteoli, which they call the Court of Vulcan, you shall hear under the earth a horrible thundering of fire and water conflicting together; and there break forth also spouts of boiling water.[2] Now that place yieldeth great quantities of bitumen; whereas Ætna and Vesuvius, and the like, which consist upon sulphur, shoot forth smoke, and ashes, and pumice, but no water. It is reported also, that bitumen mingled with lime, and put under water, will make as it were an artificial rock; the substance becometh so hard.

[1] Sandys, p. 203. Sandys is speaking of the Greek wines made on the sides of Vesuvius.

[2] Id. p. 210.

Experiment solitary touching plaster growing as hard as marble.

784. There is a cement compounded of flour, whites of eggs, and stone powdered, that becometh hard as marble: wherewith Piscina Mirabilis, near Cuma, is said to have the walls plastered.[1] And it is certain and tried, that the powder of loadstone and flint, by the addition of whites of eggs and gum-dragon, made into paste, will in a few days harden to the hardness of a stone.

Experiment solitary touching judgment of the cure in some ulcers and hurts.

785. It hath been noted by the ancients that in full or impure bodies, ulcers or hurts in the legs are hard to cure; and in the head more easy.[2] The cause is, for that ulcers or hurts in the legs require desiccation, which by the defluxion of humours to the lower parts is hindered: whereas hurts and ulcers in the head require it not; but contrariwise dryness maketh them more apt to consolidate. And in modern observation, the like difference hath been found between Frenchmen and Englishmen; whereof the one's constitution is more dry, and the other's more moist. And therefore a hurt of the head is harder to cure in a Frenchman, and of the leg in an Englishman.

Experiment solitary touching the healthfulness or unhealthfulness of the southern wind.

786. It hath been noted by the ancients that southern winds blowing much without rain, do cause a fever-

[1] Sandys, p. 231. [2] Arist. Prob. i. 18.

ous disposition of the year; but with rain, not.[1] The cause is, for that southern winds do of themselves qualify the air to be apt to cause fevers; but when showers are joined, they do refrigerate in part, and check the sultry heat of the southern wind. Therefore this holdeth not in the sea coasts, because the vapour of the sea, without showers, doth refresh.

Experiment solitary touching wounds.

787. It hath been noted by the ancients, that wounds which are made with brass heal more easily than wounds made with iron.[2] The cause is, for that brass hath in itself a sanative virtue; and so in the very instant helpeth somewhat: but iron is corrosive and not sanative. And therefore it were good, that the instruments which are used by chirurgeons about wounds were rather of brass than iron.

Experiment solitary touching mortification by cold.

788. In the cold countries, when men's noses and ears are mortified and (as it were) gangrened with cold, if they come to a fire they rot off presently. The cause is, for that the few spirits that remain in those parts are suddenly drawn forth, and so putrefaction is made complete. But snow put upon them helpeth: for that it preserveth those spirits that remain, till they can revive; and besides, snow hath in it a secret warmth: as the monk proved out of the text, *qui dat nivem sicut lanam, gelu sicut cineres spargit;*[3] whereby he did infer, that snow did warm like wool, and frost did fret like ashes. Warm water also

[1] Arist. Prob. i. 23. [2] Id. ib. i. 35.

[3] Ps. cxlvii. 16.

doth good; because by little and little it openeth the pores, without any sudden working upon the spirits. This experiment may be transferred unto the cure of gangrenes, either coming of themselves, or induced by too much applying of opiates; wherein you must beware of dry heat, and resort to things that are refrigerant, with an inward warmth and virtue of cherishing.

Experiment solitary touching weight.

789. Weigh iron and aqua fortis severally; then dissolve the iron in the aqua fortis, and weigh the dissolution; and you shall find it to bear as good weight as the bodies did severally; notwithstanding a good deal of waste by a thick vapour that issueth during the working; which sheweth that the opening of a body doth increase the weight. This was tried once or twice, but I know not whether there were any error in the trial.

Experiment solitary touching the super-natation of bodies.

790. Take of aqua fortis two ounces, of quicksilver two drachms (for that charge the aqua fortis will bear); the dissolution will not bear a flint as big as a nutmeg: yet (no doubt) the increasing of the weight of water will increase his power of bearing; as we see brine, when it is salt enough, will bear an egg. And I remember well a physician, that used to give some mineral baths for the gout, &c.; and the body, when it was put into the bath, could not get down so easily as in ordinary water. But it seemeth the weight of the quicksilver more than the weight of a stone, doth

not compense the weight of a stone more than the weight of the aqua fortis.

Experiment solitary touching the flying of unequal bodies in the air.

791. Let there be a body of unequal weight (as of wood and lead, or bone and lead); if you throw it from you with the light end forward, it will turn, and the weightier end will recover to be forwards; unless the body be over-long. The cause is, for that the more dense body hath a more violent pressure of the parts from the first impulsion; which is the cause (though heretofore not found out, as hath been often said) of all violent motions; and when the hinder part moveth swifter (for that it less endureth pressure of parts) than the forward part can make way for it, it must needs be that the body turn over: for (turned) it can more easily draw forward the lighter part. Galilæus[1] noteth it well, that if an open trough, wherein water is, be driven faster than the water can follow, the water gathereth upon an heap towards the hinder end, where the motion began; which he supposeth (holding confidently the motion of the earth,) to be the cause of the ebbing and flowing of the ocean: because the earth over-runneth the water. Which theory though it be false, yet the first experiment is true. As for the inequality of the pressure of parts, it appeareth manifestly in this: that if you take a body of stone or iron, and another of wood, of the same magnitude and shape, and throw them with equal force, you cannot possibly throw the wood so far as the stone or iron.

[1] See his Dialogi dei Sistemi Massimi.

Experiment solitary touching water, that it may be the medium of sounds.

792. It is certain (as it hath been formerly in part touched) that water may be the medium of sounds. If you dash a stone against a stone in the bottom of the water, it maketh a sound. So a long pole struck upon gravel in the bottom of the water maketh a sound. Nay, if you should think that the sound cometh up by the pole, and not by the water, you shall find that an anchor let down by a rope maketh a sound: and yet the rope is no solid body whereby the sound can ascend.

Experiment solitary of the flight of the spirits upon odious objects.

793. All objects of the senses which are very offensive, do cause the spirits to retire: and upon their flight the parts are (in some degree) destitute; and so there is induced in them a trepidation and horror. For sounds, we see that the grating of a saw, or any very harsh noise, will set the teeth on edge, and make all the body shiver. For tastes, we see that in the taking of a potion, or pills, the head and the neck shake. For odious smells, the like effect followeth; which is less perceived, because there is a remedy at hand by stopping of the nose; but in horses, that can use no such help, we see the smell of a carrion, especially of a dead horse, maketh them fly away, and take on almost as if they were mad. For feeling, if you come out of the sun suddenly into a shade, there followeth a chillness or shivering in all the body. And even in sight, which hath (in effect) no odious object,

coming into sudden darkness induceth an offer to shiver.

Experiment solitary touching the super-reflexion of echoes.

794. There is in the city of Ticinum[1] in Italy, a church that hath windows only from above: it is in length an hundred feet, in breadth twenty feet, and in height near fifty; having a door in the midst. It reporteth the voice twelve or thirteen times, if you stand by the close end-wall over against the door. The echo fadeth, and dieth by little and little, as the echo at Pont-Charenton doth. And the voice soundeth as if it came from above the door. And if you stand at the lower end, or on either side of the door, the echo holdeth; but if you stand in the door, or in the midst just over against the door, not. Note that all echoes sound better against old walls than new; because they are more dry and hollow.

Experiment solitary touching the force of imagination imitating that of the sense.

795. Those effects which are wrought by the percussion of the sense, and by things in fact, are produced likewise in some degree by the imagination. Therefore if a man see another eat sour or acid things which set the teeth on edge, this object tainteth the imagination; so that he that seeth the thing done by another, hath his own teeth also set on edge. So if a man see another turn swiftly and long, or if he look upon wheels that turn, himself waxeth turn-sick. So if a

[1] That is, Pavia. For an account of the echo there, see Maiolus, *Dies Caniculares.*

man be upon an high place without rails or good hold, except he be used to it, he is ready to fall: for imagining a fall, it putteth his spirits into the very action of a fall. So many upon the seeing of others bleed, or strangled, or tortured, themselves are ready to faint, as if they bled, or were in strife.[1]

Experiment solitary touching preservation of bodies.

796. Take a stock-gilly-flower, and tie it gently upon a stick and put them both into a stoop-glass full of quicksilver, so that the flower be covered: then lay a little weight upon the top of the glass that may keep the stick down; and look upon them after four or five days; and you shall find the flower fresh, and the stalk harder and less flexible than it was. If you compare it with another flower gathered at the same time, it will be the more manifest. This sheweth that bodies do preserve excellently in quicksilver; and not preserve only, but by the coldness of the quicksilver indurate; for the freshness of the flower may be merely conservation; (which is the more to be observed, because the quicksilver presseth the flower;) but the stiffness of the stalk cannot be without induration, from the cold (as it seemeth) of the quicksilver.

Experiment solitary touching the growth or multiplying of metals.

797. It is reported by some of the ancients that in Cyprus there is a kind of iron, that being cut into little pieces and put into the ground, if it be well watered, will increase into greater pieces.[2] This is

[1] Arist. Prob. vii. 7.

[2] Arist. Mirab. 43. But it is doubtful whether the pseudo-Aristotle is

certain, and known of old, that lead will multiply and increase; as hath been seen in old statua's of stone which have been put in cellars; the feet of them being bound with leaden bands; where (after a time) there appeared that the lead did swell; insomuch as it hanged upon the stone like warts.

Experiment solitary touching the drowning of the more base metal in the more precious.

798. I call drowning of metals, when that the baser metal is so incorporate with the more rich as it can by no means be separated again; which is a kind of version, though false: as if silver should be inseparably incorporated with gold; or copper and lead with silver. The ancient electrum had in it a fifth of silver to the gold;[1] and made a compound metal, as fit for most uses as gold, and more resplendent, and more qualified in some other properties; but then that was easily separated. This to do privily, or to make the compound pass for the rich metal simple, is an adulteration or counterfeiting: but if it be done avowedly, and without disguising, it may be a great saving of the richer metal. I remember to have heard of a man skilful in metals, that a fifteenth part of silver incorporate with gold will not be recovered by any water of separation, except you put a greater quantity of silver to draw to it the less; which (he said) is the last refuge in separations.[2] But that is a tedious way, which no man (almost) will think on. This would

speaking of iron or of brass. The best editions are in favour of the latter.

[1] Pliny, xxxiii. 23.; but compare Hardouin's note. On the subject of Electrum, see an essay in Buttmann's *Mythologus*.

[2] This is called quartation.

be better inquired: and the quantity of the fifteenth turned to a twentieth: and likewise with some little additional, that may further the intrinsic incorporation. Note that silver in gold will be detected, by weight compared with the dimension; but lead in silver (lead being the weightier metal) will not be detected, if you take so much the more silver as will countervail the over-weight of the lead.[1]

Experiment solitary touching fixation of bodies.

799. Gold is the only substance which hath nothing in it volatile, and yet melteth without much difficulty. The melting sheweth that it is not jejune, or scarce in spirit. So that the fixing of it is not want of spirit to fly out, but the equal spreading of the tangible parts, and the close coacervation of them: whereby they have the less appetite, and no means at all to issue forth. It were good therefore to try, whether glass remolten do leese any weight? for the parts in glass are evenly spread; but they are not so close as in gold; as we see by the easy admission of light, heat, and cold; and by the smallness of the weight. There be other bodies fixed, which have little or no spirit; so as there is nothing to fly out; as we see in the

[1] It is strange that Bacon should not have seen that by taking away more silver you diminish the dimension. The only way in which an alloy of lead and silver could escape detection by the test used by Archimedes, or at least by more exact methods of the same kind, would be to make some part of the work hollow. But if this was Bacon's meaning, he has not expressed it. It is yet more strange, the intention of the experiment being to effect a saving of the precious metal, that he should have spoken as if turning a fifteenth into a twentieth were an improvement. But perhaps he meant to make detection yet more difficult. We may remark farther, that all gold in common use contains more than a fifteenth of alloy. The money standard of England, which is above the average of continental coinages, contains one part of alloy to eleven of fine gold.

stuff whereof copples are made, which they put into furnaces; upon which fire worketh not. So that there are three causes of fixation; the even spreading both of the spirits and tangible parts; the closeness of the tangible parts; and the jejuneness or extreme comminution of spirits: of which three, the two first may be joined with a nature liquefiable, the last not.

Experiment solitary touching the restless nature of things in themselves, and their desire to change.

800. It is a profound contemplation in nature, to consider of the emptiness (as we may call it) or insatisfaction of several bodies; and of their appetite to take in others. Air taketh in lights, and sounds, and smells, and vapours; and it is most manifest that it doth it with a kind of thirst, as not satisfied with his own former consistence; for else it would never receive them in so suddenly and easily. Water and all liquors do hastily receive dry and more terrestrial bodies, proportionable: and dry bodies, on the other side, drink in waters and liquors: so that (as it was well said by one of the ancients, of earthy and watery substances) one is a glue to another. Parchment, skins, cloth, &c., drink in liquors, though themselves be entire bodies, and not comminuted, as sand and ashes, nor apparently porous: metals themselves do receive in readily strong-waters; and strong-waters likewise do readily pierce into metals and stones: and that strong-water will touch upon gold, that will not touch upon silver; and *è converso*. And gold, which seemeth by the weight to be the closest and most solid body, doth greedily drink in quicksilver. And it seemeth that this reception of other bodies is not vio-

lent: for it is many times reciprocal, and as it were with consent. Of the cause of this, and to what axiom it may be referred, consider attentively: for as for the pretty assertion, that matter is like a common strumpet that desireth all forms, it is but a wandering notion. Only flame doth not content itself to take in any other body; but either to overcome and turn another body into itself, as by victory; or itself to die, and go out.

NATURAL HISTORY.

CENTURY IX.

Experiments in consort touching perception in bodies insensible, tending to natural divination or subtile trials.

It is certain that all bodies whatsoever, though they have no sense, yet they have perception: for when one body is applied to another, there is a kind of election to embrace that which is agreeable, and to exclude or expel that which is ingrate: and whether the body be alterant or altered, evermore a perception precedeth operation; for else all bodies would be alike one to another. And sometimes this perception, in some kind of bodies, is far more subtile than the sense; so that the sense is but a dull thing in comparison of it: we see a weather-glass will find the least difference of the weather in heat or cold, when men find it not. And this perception also is sometimes at distance, as well as upon the touch; as when the loadstone draweth

iron; or flame fireth naphtha of Babylon, a great distance off.[1] It is therefore a subject of a very noble inquiry, to inquire of the more subtile perceptions; for it is another key to open nature, as well as the sense; and sometimes better. And besides, it is a principal means of natural divination; for that which in these perceptions appeareth early, in the great effects cometh long after. It is true also that it serveth to discover that which is hid, as well as to foretell that which is to come; as it is in many subtile trials; as to try whether seeds be old or new, the sense cannot inform; but if you boil them in water, the new seeds will sprout sooner: and so of water, the taste will not discover the best water; but the speedy consuming of it, and many other means which we have heretofore set down, will discover it. So in all physiognomy, the lineaments of the body will discover those natural inclinations of the mind, which dissimulation will conceal, or discipline will suppress. We shall therefore now handle only those two perceptions, which pertain to natural divination and discovery; leaving the handling of perception in other things to be disposed elsewhere. Now it is true that divination is attained by other means; as if you know the causes, if you know the concomitants, you may judge of the effect to follow: and the like may be said of discovery; but we tie our-

[1] Pliny, ii. 109.

selves here to that divination and discovery chiefly, which is caused by an early or subtile perception.

The aptness or propension of air or water to corrupt or putrefy, (no doubt) is to be found before it break forth into manifest effects of diseases, blastings, or the like. We will therefore set down some prognostics of pestilential and unwholesome years.

801. The wind blowing much from the south without rain, and worms in the oak-apple, have been spoken of before. Also the plenty of frogs, grasshoppers, flies, and the like creatures bred of putrefaction, doth portend pestilential years.

802. Great and early heats in the spring (and namely in May) without winds, portend the same; and generally so do years with little wind or thunder.

803. Great droughts in summer lasting till towards the end of August, and some gentle showers upon them, and then some dry weather again, do portend a pestilent summer the year following: for about the end of August all the sweetness of the earth, which goeth into plants or trees, is exhaled (and much more if the August be dry); so that nothing then can breathe forth of the earth but a gross vapour, which is apt to corrupt the air: and that vapour, by the first showers, if they be gentle, is released, and cometh forth abundantly. Therefore they that come abroad soon after those showers, are commonly taken with sickness: and in Africk, nobody will stir out of doors after the first showers. But if the showers come vehemently, then they rather wash and fill the earth, than give it

leave to breathe forth presently. But if dry weather come again, then it fixeth and continueth the corruption of the air, upon the first showers begun; and maketh it of ill influence, even to the next summer; except a very frosty winter discharge it; which seldom succeedeth such droughts.

804. The lesser infections, of the small-pox, purple fevers, agues, in the summer precedent, and hovering all winter, do portend a great pestilence in the summer following; for putrefaction doth not rise to his height at once.

805. It were good to lay a piece of raw flesh or fish in the open air; and if it putrefy quickly, it is a sign of a disposition in the air to putrefaction. And because you cannot be informed whether the putrefaction be quick or late, except you compare this experiment with the like experiment in another year, it were not amiss in the same year, and at the same time, to lay one piece of flesh or fish in the open air, and another of the same kind and bigness within doors: for I judge, that if a general disposition be in the air to putrefy, the flesh or fish will sooner putrefy abroad, where the air hath more power, than in the house, where it hath less, being many ways corrected. And this experiment would be made about the end of March: for that season is likest to discover what the winter hath done, and what the summer following will do, upon the air. And because the air (no doubt) receiveth great tincture and infusion from the earth; it were good to try that exposing of flesh or fish, both upon a stake of wood some height above the earth, and upon the flat of the earth.

806. Take May-dew, and see whether it putrefy

quickly or no; for that likewise may disclose the quality of the air, and vapour of the earth, more or less corrupted.

807. A dry March, and a dry May, portend a wholesome summer, if there be a showering April between: but otherwise it is a sign of a pestilential year.

808. As the discovery of the disposition of the air is good for the prognostics of wholesome and unwholesome years; so it is of much more use for the choice of places to dwell in: at the least, for lodges and retiring places for health (for mansion-houses respect provisions as well as health); wherein the experiments above-mentioned may serve.

809. But for the choice of places or seats, it is good to make trial not only of aptness of air to corrupt, but also of the moisture and dryness of the air, and the temper of it in heat or cold; for that may concern health diversly. We see that there be some houses wherein sweet-meats will relent, and baked meats will mould, more than in others; and wainscots will also sweat more; so that they will almost run with water: all which (no doubt) are caused chiefly by the moistness of the air in those seats. But because it is better to know it before a man buildeth his house, than to find it after, take the experiments following.

810. Lay wool, or a spunge, or bread, in the place you would try, comparing it with some other places; and see whether it doth not moisten, and make the wool, or spunge, &c., more ponderous than the other: and if it do, you may judge of that place as situate in a gross and moist air.

811. Because it is certain that in some places, either

by the nature of the earth, or by the situation of woods and hills, the air is more unequal than in others; and inequality of air is ever an enemy to health; it were good to take two weather-glasses, matches in all things, and to set them, for the same hours of one day, in several places, where no shade is, nor inclosures; and to mark when you set them, how far the water cometh; and to compare them, when you come again, how the water standeth then; and if you find them unequal, you may be sure that the place where the water is lowest is in the warmer air, and the other in the colder. And the greater the inequality be of the ascent or descent of the water, the greater is the inequality of the temper of the air.

812. The predictions likewise of cold and long winters, and hot and dry summers, are good to be known; as well for the discovery of the causes, as for divers provisions. That of plenty of haws, and heps, and briar-berries, hath been spoken of before. If wainscot, or stone, that have used to sweat, be more dry in the beginning of winter; or the drops of the eaves of houses come more slowly down than they use; it portendeth a hard and frosty winter. The cause is, for that it sheweth an inclination of the air to dry weather; which in winter is ever joined with frost.

813. Generally a moist and a cool summer portendeth a hard winter. The cause is, for that the vapours of the earth are not dissipated in the summer by the sun; and so they rebound upon the winter.

814. A hot and dry summer and autumn, and especially if the heat and drought extend far into September, portendeth an open beginning of winter; and colds to succeed, toward the latter part of the winter

and the beginning of the spring: for till then the former heat and drought bear the sway, and the vapours are not sufficiently multiplied.

815. An open and warm winter portendeth a hot and dry summer; for the vapours disperse into the winter showers; whereas cold and frost keepeth them in, and transporteth them into the late spring and summer following.

816. Birds that use to change countries at certain seasons, if they come earlier, do shew the temperature of weather, according to that country whence they came: as the winter-birds, (namely, woodcocks, feldfares, &c.) if they come earlier, and out of the northern countries, with us shew cold winters. And if it be in the same country, then they shew a temperature of season like unto that season in which they come: as swallows, bats, cuckoos, &c., that come towards summer, if they come early, shew a hot summer to follow.

817. The prognostics, more immediate, of weather to follow soon after, are more certain than those of seasons. The resounding of the sea upon the shore; and the murmur of winds in the woods, without apparent wind; shew wind to follow: for such winds breathing chiefly out of the earth, are not at the first perceived, except they be pent by water or wood. And therefore a murmur out of caves likewise portendeth as much.[1]

818. The upper regions of the air perceive the collection of the matter of tempests and winds, before the air here below: and therefore the obscuring of the smaller stars is a sign of tempests following. And of

[1] Most of these prognostics are mentioned by Pliny.

this kind you shall find a number of instances in our inquisition *De Ventis*.

819. Great mountains have a perception of the disposition of the air to tempests, sooner than the valleys or plains below: and therefore they say in Wales, when certain hills have their night-caps on, they mean mischief. The cause is, for that tempests, which are for the most part bred above in the middle region (as they call it), are soonest perceived to collect in the places next it.

820. The air, and fire, have subtile perceptions of wind rising, before men find it. We see the trembling of a candle will discover a wind that otherwise we do not feel; and the flexuous burning of flames doth shew the air beginneth to be unquiet; and so do coals of fire by casting off the ashes more than they use. The cause is, for that no wind at the first, till it hath struck and driven the air, is apparent to the sense; but flame is easier to move than air: and for the ashes, it is no marvel, though wind unperceived shake them off; for we usually try which way the wind bloweth, by casting up grass, or chaff, or such light things into the air.

821. When wind expireth from under the sea, as it causeth some resounding of the water (whereof we spake before), so it causeth some light motions of bubbles, and white circles of froth. The cause is, for that the wind cannot be perceived by the sense, until there be an eruption of a great quantity from under the water; and so it getteth into a body: whereas in the first putting up it cometh in little portions.

822. We spake of the ashes that coals cast off; and of grass and chaff carried by the wind: so any light thing that moveth when we find no wind, sheweth a

wind at hand; as when feathers, or down of thistles, fly to and fro in the air.

For prognostics of weather from living creatures, it is to be noted that creatures that live in the open air (*sub dio*) must needs have a quicker impression from the air, than men that live most within doors; and especially birds who live in the air freest and clearest; and are aptest by their voice to tell tales what they find, and likewise by the motion of their flight to express the same.

823. Water-fowls, (as sea-gulls, moor-hens, &c.) when they flock and fly together from the sea towards the shores; and contrariwise, land-birds, (as crows, swallows, &c.) when they fly from the land to the waters, and beat the waters with their wings; do foreshew rain and wind. The cause is, pleasure that both kinds take in the moistness and density of the air; and so desire to be in motion and upon the wing, whithersoever they would otherwise go; for it is no marvel, that water-fowl do joy most in that air which is likest water; and land-birds also, many of them, delight in bathing, and moist air. For the same reason also, many birds do prune[1] their feathers; and geese do gaggle; and crows seem to call upon rain: all which is but the comfort they seem to receive in the relenting of the air.

824. The heron, when she soareth high, (so as sometimes she is seen to pass over a cloud,) sheweth winds: but kites flying aloft shew fair and dry weather. The cause may be, for that they both mount most

[1] *Proine* in the original. — *J. S.*

into the air of that temper wherein they delight: and the heron, being a water-fowl, taketh pleasure in the air that is condensed; and besides, being but heavy of wing, needeth the help of the grosser air. But the kite affecteth not so much the grossness of the air, as the cold and freshness thereof: for being a bird of prey, and therefore hot, she delighteth in the fresh air; and (many times) flieth against the wind, as trouts and salmons swim against the stream. And yet it is true also, that all birds find an ease in the depth of the air, as swimmers do in a deep water. And therefore when they are aloft, they can uphold themselves with their wings spread, scarce moving them.

825. Fishes, when they play towards the top of the water, do commonly foretell rain. The cause is, for that a fish, hating the dry, will not approach the air till it groweth moist; and when it is dry, will fly it, and swim lower.

826. Beasts do take comfort (generally) in a moist air; and it maketh them eat their meat better; and therefore sheep will get up betimes in the morning to feed, against rain: and cattle, and deer, and coneys, will feed hard before rain; and a heifer will put up his nose and snuff in the air, against rain.

827. The trefoil, against rain, swelleth in the stalk; and so standeth more upright: for by wet, stalks do erect, and leaves bow down. There is a small red flower in the stubble-fields, which country people call the wincopipe; which if it open in the morning, you may be sure of a fair day to follow.

828. Even in men, aches and hurts and corns do engrieve, either towards rain or towards frost: for the one maketh the humours more to abound; and the

other maketh them sharper. So we see both extremes bring the gout.

829. Worms, vermin, &c., do foreshew likewise rain: for earthworms will come forth, and moles will cast up more, and fleas bite more, against rain.

830. Solid bodies likewise foreshew rain. As stones and wainscot, when they sweat: and boxes and pegs of wood, when they draw and wind hard; though the former be but from an outward cause; for that the stone or wainscot turneth and beateth back the air against itself; but the latter is an inward swelling of the body of the wood itself.

Experiment solitary touching the nature of appetite in the stomach.

831. Appetite is moved chiefly by things that are cold and dry: the cause is, for that cold is a kind of indigence of nature, and calleth upon supply; and so is dryness: and therefore all sour things (as vinegar, juice of lemons, oil of vitriol, &c.) provoke appetite. And the disease which they call *appetitus caninus*, consisteth in the matter of an acid and glassy phlegm in the mouth of the stomach. Appetite is also moved by sour things; for that sour things induce a contraction in the nerves placed in the mouth of the stomach; which is a great cause of appetite. As for the cause why onions, and salt, and pepper, in baked meats, move appetite, it is by vellication of those nerves; for motion whetteth. As for wormwood, olives, capers, and others of that kind, which participate of bitterness, they move appetite by abstersion. So as there be four principal causes of appetite; the refrigeration of the stomach, joined with some dryness; contraction; velli-

cation; and abstersion; besides hunger, which is an emptiness: and yet over-fasting doth (many times) cause the appetite to cease; for that want of meat maketh the stomach draw humours, and such humours as are light and choleric, which quench appetite most.

Experiment solitary touching sweetness of odour from the rainbow.

832. It hath been observed by the ancients, that where a rainbow seemeth to hang over or to touch, there breatheth forth a sweet smell.[1] The cause is, for that this happeneth but in certain matters which have in themselves some sweetness; which the gentle dew of the rainbow doth draw forth: and the like do soft showers; for they also make the grounds sweet: but none are so delicate as the dew of the rainbow where it falleth. It may be also that the water itself hath some sweetness; for the rainbow consisteth of a glomeration of small drops, which cannot possibly fall but from the air that is very low; and therefore may hold the very sweetness of the herbs and flowers, as a distilled water; for rain, and other dew, that fall from high, cannot preserve the smell, being dissipated in the drawing up: neither do we know whether some water itself may not have some degree of sweetness. It is true that we find it sensibly in no pool, river, nor fountain; but good earth, newly turned up, hath a freshness and good scent; which water, if it be not too equal, (for equal objects never move the sense,) may also have. Certain it is, that bay-salt, which is but a kind of water congealed, will sometimes smell like violets.

[1] Arist. Prob. xii. 2.

Experiment solitary touching sweet smells.

833. To sweet smells heat is requisite, to concoct the matter; and some moisture, to spread the breath of them. For heat, we see that woods and spices are more odorate in the hot countries than in the cold: for moisture, we see that things too much dried lose their sweetness: and flowers growing, smell better in a morning or evening than at noon. Some sweet smells are destroyed by approach to the fire; as violets, wall-flowers, gilly-flowers, pinks; and generally all flowers that have cool and delicate spirits. Some continue both on the fire, and from the fire; as rose-water, &c. Some do scarce come forth, or at least not so pleasantly, as by means of the fire; as juniper, sweet gums, &c., and all smells that are enclosed in a fast body: but (generally) those smells are the most grateful, where the degree of heat is small; or where the strength of the smell is allayed; for these things do rather woo the sense, than satiate it. And therefore the smell of violets and roses exceedeth in sweetness that of spices and gums; and the strongest sort of smells are best in a weft afar off.

Experiment solitary touching the corporeal substance of smells.

834. It is certain that no smell issueth but with emission of some corporeal substance; not as it is in light and colours, and in sounds. For we see plainly that smell doth spread nothing that distance that the other do. It is true that some woods of oranges, and heaths of rosemary, will smell a great way into the sea, perhaps twenty miles; but what is that, since a peal

of ordnance will do as much, which moveth in a small compass? whereas those woods and heaths are of vast spaces; besides, we see that smells do adhere to hard bodies; as in perfuming of gloves, &c.; which showeth them corporeal; and do last a great while, which sounds and light do not.

Experiment solitary touching fetid and fragrant odours.

835. The excrements of most creatures smell ill; chiefly to the same creature that voideth them: for we see, besides that of man, that pigeons and horses thrive best, if their houses and stables be kept sweet: and so of cage birds: and the cat burieth that which she voideth: and it holdeth chiefly in those beasts which feed upon flesh. Dogs (almost) only of beasts delight in fetid odours; which showeth there is somewhat in their sense of smell differing from the smells of other beasts. But the cause why excrements smell ill, is manifest; for that the body itself rejecteth them; much more the spirits: and we see that those excrements that are of the first digestion, smell the worst; as the excrements from the belly; those that are from the second digestion less ill; as urine: and those that are from the third, yet less; for sweat is not so bad as the other two; especially of some persons, that are full of heat. Likewise most putrefactions are of an odious smell: for they smell either fetid or mouldy. The cause may be, for that putrefaction doth bring forth such a consistence, as is most contrary to the consistence of the body whilst it is sound: for it is a mere dissolution of that form. Besides, there is another reason, which is profound: and it is, that the objects that please any of the senses

have all some equality, and (as it were) order, in their composition; but where those are wanting, the object is ever ingrate. So mixture of many disagreeing colours is ever unpleasant to the eye: mixture of discordant sounds is unpleasant to the ear: mixture or hotch-potch of many tastes is unpleasant to the taste: harshness and ruggedness of bodies is unpleasant to the touch: now it is certain that all putrefaction, being a dissolution of the first form, is a mere confusion and unformed mixture of the part. Nevertheless it is strange, and seemeth to cross the former observation, that some putrefactions and excrements do yield excellent odours; as civet and musk; and, as some think, ambergrise: for divers take it, though unprobably, to come from the sperm of fish: and the moss we spake of from apple trees is little better than an excretion. The reason may be, for that there passeth in the excrements, and remaineth in the putrefactions, some good spirits; especially where they proceed from creatures that are very hot. But it may be also joined with a further cause, which is more subtile; and it is, that the senses love not to be over-pleased, but to have a commixture of somewhat that is in itself ingrate. Certainly we see how discords in music, falling upon concords, make the sweetest strains: and we see again what strange tastes delight the taste; as red herrings, caviary, parmesan, &c. And it may be the same holdeth in smells: for those kind of smells that we have mentioned are all strong, and do pull and vellicate the sense. And we find also, that places where men urine, commonly have some smell of violets: and urine, if one hath eaten nutmeg, hath so too.

The slothful, general, and indefinite contemplations and notions of the elements and their conjugations; of the influences of heaven; of heat, cold, moisture, drought; qualities active, passive; and the like; have swallowed up the true passages, and processes, and affects, and consistencies of matter and natural bodies. Therefore they are to be set aside, being but notional and ill limited; and definite axioms are to be drawn out of measured instances: and so ascent[1] to be made to the more general axioms, by scale. And of these kinds of processes of natures and characters of matter, we will now set down some instances.

Experiment solitary touching the causes of putrefaction.

836. All putrefactions come chiefly from the inward spirits of the body; and partly also from the ambient body, be it air, liquor, or whatsoever else. And this last by two means: either by ingress of the substance of the ambient body into the body putrefied; or by excitation and solicitation of the body putrefied, and the parts thereof, by the body ambient. As for the received opinion, that putrefaction is caused either by cold or peregrine and preternatural heat, it is but nugation: for cold, in things inanimate, is the greatest enemy that is to putrefaction; though it extinguisheth vivification, which ever consisteth in spirits attenuate, which the cold doth congeal and coagulate. And as for the peregrine heat, it is thus far true; that if the

[1] *Assent* in the original; a misprint, no doubt; or the mistake of an amanuensis writing from dictation.—*J. S.*

proportion of the adventive heat be greatly predominant to the natural heat and spirits of the body, it tendeth to dissolution, or notable alteration. But this is wrought by emission, or suppression, or suffocation, of the native spirits; and also by the disordination and discomposture of the tangible parts; and other passages of nature; and not by a conflict of heats.

Experiment solitary touching bodies unperfectly mixed.

837. In versions, or main alterations of bodies, there is a medium between the body as it is at first, and the body resulting; which medium is *corpus imperfecte mistum*, and is transitory, and not durable; as mists, smokes, vapours, chylus in the stomach, living creatures in the first vivification: and the middle action, which produceth such imperfect bodies, is fitly called (by some of the ancients) inquination,[1] or inconcoction, which is a kind of putrefaction; for the parts are in confusion, till they settle one way or other.

Experiment solitary touching concoction and crudity.

838. The word concoction, or digestion, is chiefly taken into use from living creatures and their organs; and from thence extended to liquors and fruits, &c. Therefore they speak of meat concocted; urine and excrements concocted; and the four digestions, (in the stomach, in the liver, in the arteries and nerves, and in the several parts of the body,) are likewise called concoctions; and they are all made to be the works of heat: all which notions are but ignorant catches of a

[1] μόλυνσις, Arist. Meteor. iv. 3. But μόλυνσις is only one kind of inconcoction, namely that which is opposed to ἕψησις or elixation. The whole train of thought, from 836. to 846. inclusive, shows that these paragraphs were suggested by the fourth book of the *Meteorologics*.

few things which are most obvious to men's observations. The constantest notion of concoction is, that it should signify the degrees of alteration of one body into another, from crudity to perfect concoction; which is the ultimity of that action or process; and while the body to be converted and altered is too strong for the efficient that should convert or alter it, (whereby it resisteth and holdeth fast in some degree the first form or consistence,) it is (all that while) crude and inconcoct; and the process is to be called crudity and inconcoction. It is true that concoction is in great part the work of heat; but not the work of heat alone: for all things that further the conversion or alteration (as rest, mixture of a body already concocted, &c.) are also means to concoction. And there are of concoction two periods; the one assimilation, or absolute conversion and subaction; the other maturation: whereof the former is most conspicuous in the bodies of living creatures; in which there is an absolute conversion and assimilation of the nourishment into the body; and likewise in the bodies of plants; and again in metals, where there is a full transmutation. The other (which is maturation) is seen in liquors and fruits; wherein there is not desired, nor pretended, an utter conversion, but only an alteration to that form which is most sought for man's use; as in clarifying of drinks, ripening of fruits, &c. But note that there be two kinds of absolute conversions; the one is, when a body is converted into another body, which was before; as when nourishment is turned into flesh: that is it which we call assimilation. The other is, when the conversion is into a body merely new, and which was not before; as if silver should be turned

to gold, or iron to copper: and this conversion is better called, for distinction's sake, transmutation.

Experiment solitary touching alterations which may be called majors.

839. There are also divers other great alterations of matter and bodies, besides those that tend to concoction and maturation; for whatsoever doth so alter a body, as it returneth not again to that it was, may be called *alteratio major;* as when meat is boiled, or roasted, or fried, &c.; or when bread and meat are baked; or when cheese is made of curds, or butter of cream, or coals of wood, or bricks of earth; and a number of others. But to apply notions philosophical to plebeian terms; or to say, where the notions cannot fitly be reconciled, that there wanteth a term or nomenclature for it (as the ancients used); they be but shifts of ignorance; for knowledge will be ever a wandering and indigested thing, if it be but a commixture of a few notions that are at hand and occur, and not excited from sufficient number of instances, and those well collated.

The consistencies of bodies are very divers:[1] dense, rare; tangible, pneumatical; volatile, fixed; determinate, not determinate; hard, soft; cleaving, not cleaving; congealable, not congealable; liquefiable, not liquefiable; fragile, tough; flexible, inflexible; tractile, or to be drawn forth in length, intractile; porous, solid; equal and smooth, unequal; venous and fibrous and with grains, entire;

[1] Compare the list in the *De Augmentis* [Vol. II. p. 281.].

and divers others; all which to refer to heat, and cold, and moisture, and drought, is a compendious and inutile speculation. But of these see principally our *Abecedarium Naturæ;* and otherwise *sparsim* in this our *Sylva Sylvarum:* nevertheless, in some good part, we shall handle divers of them now presently.

Experiment solitary touching bodies liquefiable, and not liquefiable.

840. Liquefiable, and not liquefiable, proceed from these causes: liquefaction is ever caused by the detention of the spirits, which play within the body and open it. Therefore such bodies as are more turgid of spirit, or that have their spirits more straitly imprisoned, or again that hold them better pleased and content, are liquefiable: for these three dispositions of bodies do arrest the emission of the spirits. An example of the first two properties is in metals; and of the last in grease, pitch, sulphur, butter, wax, &c. The disposition not to liquefy proceedeth from the easy emission of the spirits, whereby the grosser parts contract; and therefore bodies jejune of spirits, or which part with their spirits more willingly, are not liquefiable; as wood, clay, free-stone, &c. But yet even many of those bodies that will not melt, or will hardly melt, will notwithstanding soften: as iron in the forge; and a stick bathed in hot ashes, which thereby becometh more flexible. Moreover there are some bodies which do liquefy or dissolve by fire; as metals, wax, &c.; and other bodies which dissolve in water; as salt, sugar, &c. The cause of the former

proceedeth from the dilatation of the spirits by heat: the cause of the latter proceedeth from the opening of the tangible parts, which desire to receive the liquor. Again, there are some bodies that dissolve with both; as gum, &c. And those be such bodies, as on the one side have good store of spirit; and on the other side, have the tangible parts indigent of moisture; for the former helpeth to the dilating of the spirits by the fire; and the latter stimulateth the parts to receive the liquor.

Experiment solitary touching bodies fragile and tough.

841. Of bodies, some are fragile; and some are tough, and not fragile: and in the breaking, some fragile bodies break but where the force is; some shatter and fly in many pieces. Of fragility, the cause is an impotency to be extended; and therefore stone is more fragile than metal; and so fictile earth is more fragile than crude earth; and dry wood than green. And the cause of this unaptness to extension is the small quantity of spirits, (for it is the spirit that furthereth the extension or dilatation of bodies,) and it is ever concomitant with porosity, and with dryness in the tangible parts: contrariwise, tough bodies have more spirit, and fewer pores, and moister tangible parts: therefore we see that parchment or leather will stretch, paper will not; woollen cloth will tenter, linen scarcely.

Experiment solitary touching the two kinds of pneumaticals in bodies.

842. All solid bodies consist of parts of two several natures; pneumatical and tangible; and it is well to be noted, that the pneumatical substance is in some

bodies the native spirit of the body; and in some other, plain air that is gotten in; as in bodies desiccate by heat or age: for in them, when the native spirit goeth forth, and the moisture with it, the air with time getteth into the pores. And those bodies are ever the more fragile; for the native spirit is more yielding and extensive (especially to follow the parts) than air. The native spirits also admit great diversity; as hot, cold, active, dull, &c., whence proceed most of the virtues and qualities (as we call them) of bodies: but the air intermixed is without virtues, and maketh things insipid, and without any extimulation.

Experiment solitary touching concretion and dissolution of bodies.

843. The concretion of bodies is (commonly) solved by the contrary; as ice, which is congealed by cold, is dissolved by heat; salt and sugar, which are excocted by heat, are dissolved by cold and moisture.[1] The cause is, for that these operations are rather returns to their former nature, than alterations; so that the contrary cureth. As for oil, it doth neither easily congeal with cold, nor thicken with heat. The cause of both effects, though they be produced by contrary efficients, seemeth to be the same; and that is, because the spirit of the oil by either means exhaleth little; for the cold keepeth it in; and the heat (except it be vehement) doth not call it forth. As for cold, though it take hold of the tangible parts, yet as to the spirits, it doth rather make them swell than congeal them: as when ice is congealed in a cup, the ice will swell instead of contracting, and sometimes rift.

[1] Arist. Meteor. iv. 5.

Experiment solitary touching hard and soft bodies.

844. Of bodies, some (we see) are hard, and some soft: the hardness is caused (chiefly) by the jejuneness of the spirits, and their imparity with the tangible parts: both which, if they be in a greater degree, maketh them not only hard, but fragile, and less enduring of pressure; as steel, stone, glass, dry wood, &c. Softness cometh (contrariwise) by the greater quantity of spirits, (which ever helpeth to induce yielding and cession,) and by the more equal spreading of the tangible parts, which thereby are more sliding and following: as in gold, lead, wax, &c. But note that soft bodies (as we use the word) are of two kinds; the one, that easily giveth place to another body, but altereth not bulk, by rising in other places: and therefore we see that wax, if you put any thing into it, doth not rise in bulk, but only giveth place; for you may not think, that in printing of wax, the wax riseth up at all; but only the depressed part giveth place, and the other remaineth as it was. The other, that altereth bulk in the cession; as water, or other liquors, if you put a stone or any thing into them, they give place indeed easily, but then they rise all over; which is a false cession; for it is in place, and not in body.

Experiment solitary touching bodies ductile and tensile.

845. All bodies ductile and tensile (as metals, that will be drawn into wires; wool and tow, that will be drawn into yarn or thread,) have in them the appetite of not discontinuing, strong; which maketh them follow the force that pulleth them out; and yet so as not to discontinue or forsake their own body. Viscous

bodies likewise, as pitch, wax, bird-lime, cheese toasted, will draw forth and rope. But the difference between bodies fibrous and bodies viscous is plain: for all wool, and tow, and cotton, and silk (especially raw silk) have, besides their desire of continuance, in regard of the tenuity of their thread, a greediness of moisture; and by moisture to join and incorporate with other thread; especially if there be a little wreathing; as appeareth by the twisting of thread, and the practice of twirling about of spindles. And we see also that gold and silver thread cannot be made without twisting.

Experiment solitary touching other passions of matter, and characters of bodies.

846. The differences of impressible and not impressible; figurable and not figurable; mouldable and not mouldable; scissile and not scissile; and many other passions of matter,[1] are plebeian notions, applied unto the instruments and uses which men ordinarily practise; but they are all but the effects of some of these causes following, which we will enumerate without applying them, because that would be too long. The first is the cession or not cession of bodies into a smaller space or room, keeping the outward bulk, and not flying up. The second is the stronger or weaker appetite in bodies to continuity, and to fly discontinuity. The third is the disposition of bodies to contract, or not contract: and again, to extend, or not extend. The fourth is the small quantity or great quantity of the pneumatical in bodies. The fifth is the nature of the pneumatical, whether it be native

[1] See Aristotle's list, *Meteor.* iv. 8.

spirit of the body, or common air. The sixth is the nature of the native spirits in the body, whether they be active and eager, or dull and gentle. The seventh is the emission or detention of the spirits in bodies. The eighth is the dilatation or contraction of the spirits in bodies, while they are detained. The ninth is the collocation of the spirits in bodies; whether the collocation be equal or unequal; and again, whether the spirits be coacervate or diffused. The tenth is the density or rarity of the tangible parts. The eleventh is the equality or inequality of the tangible parts. The twelfth is the digestion or crudity of the tangible parts. The thirteenth is the nature of the matter, whether sulphureous or mercurial, watery or oily, dry and terrestrial, or moist and liquid; which natures of sulphureous and mercurial, seem to be natures radical and principal. The fourteenth is the placing of the tangible parts in length, or transverse (as it is in the warp and the woof of textiles); more inward or more outward, &c. The fifteenth is the porosity or imporosity betwixt the tangible parts, and the greatness or smallness of the pores. The sixteenth is the collocation and posture of the pores. There may be more causes; but these do occur for the present.

Experiment solitary touching induration by sympathy.

847. Take lead and melt it, and in the midst of it, when it beginneth to congeal, make a little dint or hole, and put quicksilver wrapped in a piece of linen into that hole, and the quicksilver will fix, and run no more, and endure the hammer. This is a noble instance of induration, by consent of one body with another, and motion of excitation to imitate; for to

ascribe it only to the vapour of lead, is less probable. *Quære* whether the fixing may be in such a degree, as it will be figured like other metals? For if so, you may make works of it for some purposes, so they come not near the fire.

Experiment solitary touching honey and sugar.

848. Sugar hath put down the use of honey; insomuch as we have lost those observations and preparations of honey which the ancients had, when it was more in price. First, it seemeth that there was in old time tree-honey, as well as bee-honey; which was the tear or blood issuing from the tree: insomuch as one of the ancients relateth, that in Trebisond there was honey issuing from the box-trees which made men mad.[1] Again, in ancient time there was a kind of honey which, either of the own nature or by art, would grow as hard as sugar, and was not so luscious as ours. They had also a wine of honey, which they made thus. They crushed the honey into a great quantity of water, and then strained the liquor; after, they boiled it in a copper to the half; then they poured it into earthen vessels for a small time; and after tunned it into vessels of wood, and kept it for many years. They have also at this day, in Russia and those northern countries, mead simple, which (well made and seasoned) is a good wholesome drink, and very clear. They use also in Wales a compound drink of mead, with herbs and spices. But meanwhile it were good, in recompence of that we have lost in

[1] Arist. Mirab. 17. The honey was made from box; that is, apparently, by bees which fed on the box flower. There is no authority for saying that it issued from the box tree.

honey, there were brought in use a *sugar-mead*, (for so we may call it) though without any mixture at all of honey; and to brew it, and keep it stale, as they use mead: for certainly, though it would not be so abstersive, and opening, and solutive a drink as mead: yet it will be more grateful to the stomach, and more lenitive, and fit to be used in sharp diseases: for we see that the use of sugar in beer and ale hath good effects in such cases.[1]

Experiment solitary touching the finer sort of base metals.

849. It is reported by the ancients, that there was a kind of steel in some places, which would polish almost as white and bright as silver.[2] And that there was in India a kind of brass which (being polished) could scarce be discerned from gold. This was in the natural ure:[3] but I am doubtful, whether men have sufficiently refined metals, which we count base; as whether iron, brass, or tin be refined to the height? But when they come to such a fineness as serveth the ordinary use, they try no further.

Experiment solitary touching cements and quarries.

850. There have been found certain cements under earth that are very soft; and yet, taken forth into the sun, harden as hard as marble: there are also ordinary quarries in Somersetshire, which in the quarry cut soft

[1] The sugar-wine which Bacon here recommends is well known in Spanish America, where it is called guarapo. With respect to the wine made of honey, see Pliny, xiv. 20.

[2] Arist. Mirab. 48. and 49. But the writer speaks of iron, — not of steel.

[3] So in the original. — *J. S.*

to any bigness, and in the building prove firm and hard.

Experiment solitary touching the altering of the colour of hairs and feathers.

851. Living creatures (generally) do change their hair with age, turning to be grey and white: as is seen in men, though some earlier, some later; in horses that are dappled, and turn white; in old squirrels that turn grisly; and many others. So do some birds; as cygnets from grey turn white; hawks from brown turn more white. And some birds there be that upon their moulting do turn colour; as robin-red-breasts, after their moulting, grow to be red again by degrees; so do goldfinches upon the head. The cause is, for that moisture doth (chiefly) colour hair and feathers; and dryness turneth them grey and white: now hair in age waxeth drier; so do feathers. As for feathers, after moulting, they are young feathers, and so all one as the feathers of young birds. So the beard is younger than the hair of the head, and doth (for the most part) wax hoar later. Out of this ground a man may devise the means of altering the colour of birds, and the retardation of hoar hairs. But of this see in the fifth experiment.

Experiment solitary touching the differences of living creatures, male and female.

852. The difference between male and female, in some creatures, is not to be discerned, otherwise than in the parts of generation: as in horses and mares, dogs and bitches, doves he and she, and others. But some differ in magnitude, and that diversly; for in

most the male is the greater; as in man, pheasants, peacocks, turkeys, and the like: and in some few, as in hawks, the female. Some differ in the hair and feathers, both in the quantity, crispation, and colours of them; as he-lions are hirsute, and have great manes: the shes are smooth like cats. Bulls are more crisp upon the forehead than cows; the peacock, and pheasant-cock, and goldfinch-cock, have glorious and fine colours; the hens have not. Generally the hes in birds have the fairest feathers. Some differ in divers features: as bucks have horns, does none; rams have more wreathed horns than ewes; cocks have great combs and spurs, hens little or none; boars have great fangs, sows much less; the turkey-cock hath great and swelling gills, the hen hath less: men have generally deeper and stronger voices than women. Some differ in faculty; as the cocks amongst singing-birds are the best singers. The chief cause of all these (no doubt) is, for that the males have more strength of heat than the females; which appeareth manifestly in this, that all young creatures males[1] are like females; and so are eunuchs, and gelt creatures of all kinds, liker females. Now heat causeth greatness of growth, generally, where there is moisture enough to work upon: but if there be found in any creature (which is seen rarely) an over-great heat in proportion to the moisture, in them the female is the greater; as in hawks and sparrows. And if the heat be balanced with the moisture, then there is no difference to be seen between male and female; as in the instances of horses and dogs. We see also that the horns of oxen and cows,

[1] That is, young male creatures. So we have *merchants strangers, letters patents*, &c.—*J. S.*

for the most part, are larger than the bulls; which is caused by abundance of moisture, which in the horns of the bull faileth. Again, heat causeth pilosity and crispation; and so likewise beards in men. It also expelleth finer moisture, which want of heat cannot expel; and that is the cause of the beauty and variety of feathers. Again, heat doth put forth many excrescences, and much solid matter, which want of heat cannot do: and this is the cause of horns, and of the greatness of them; and of the greatness of the combs and spurs of cocks, gills of turkey-cocks, and fangs of boars. Heat also dilateth the pipes and organs, which causeth the deepness of the voice. Again, heat refineth the spirits, and that causeth the cock singing-bird to excel the hen.

Experiment solitary touching the comparative magnitude of living creatures.

853. There be fishes greater than any beasts; as the whale is far greater than the elephant: and beasts are (generally) greater than birds. For fishes, the cause may be, that because they live not in the air, they have not their moisture drawn and soaked by the air and sun-beams. Also they rest always in a manner, and are supported by the water; whereas motion and labour do consume. As for the greatness of beasts more than of birds, it is caused, for that beasts stay longer time in the womb than birds, and there nourish and grow; whereas in birds, after the egg laid, there is no further growth or nourishment from the female; for the sitting doth vivify, and not nourish.

Experiment solitary touching exossation of fruits.

854. We have partly touched before the means of producing fruits without cores or stones. And this we add further, that the cause must be abundance of moisture; for that the core and stone are made of a dry sap: and we see that it is possible to make a tree put forth only in blossom, without fruit; as in cherries with double flowers; much more into fruit without stone or cores. It is reported, that a scion of an apple, grafted upon a colewort-stalk, sendeth forth a great apple without a core. It is not unlikely that if the inward pith of a tree were taken out, so that the juice came only by the bark, it would work the effect. For it hath been observed that in pollards, if the water get in on the top, and they become hollow, they put forth the more. We add also, that it is delivered for certain by some, that if the scion be grafted the small end downwards, it will make fruit have little or no cores and stones.

Experiment solitary touching the melioration of tobacco.

855. Tobacco is a thing of great price, if it be in request: for an acre of it will be worth (as is affirmed) two hundred pounds by the year towards charge.[1] The charge of making the ground and otherwise is great, but nothing to the profit. But the English tobacco hath small credit, as being too dull and earthy: nay, the Virginian tobacco, though that be in a hotter climate, can get no credit for the same cause: so that

[1] In France the average yield of a hectare of tobacco was, in 1841, 1185 kilogrammes (Boussingault, Economie Rurale, vol. i. p. 435.), which is about equivalent to 1058 pounds the acre. At this rate the price in Bacon's time must have been about 3*s.* 9*d.* a pound.

a trial to make tobacco more aromatical, and better concocted, here in England, were a thing of great profit. Some have gone about to do it by drenching the English tobacco in a decoction or infusion of Indian tobacco; but those are but sophistications and toys; for nothing that is once perfect, and hath run his race, can receive much amendment. You must ever resort to the beginnings of things for melioration. The way of maturation of tobacco must, as in other plants, be from the heat either of the earth or of the sun: we see some leading of this in musk-melons; which are sown upon a hot-bed, dunged below, upon a bank turned upon the south sun, to give heat by reflexion; laid upon tiles, which increaseth the heat; and covered with straw to keep them from cold. They remove them also, which addeth some life: and by these helps they become as good in England, as in Italy or Provence. These, and the like means, may be tried in tobacco. Inquire also of the steeping of roots in some such liquor as may give them vigour to put forth strong.

Experiment solitary touching several heats working the same effects.

856. Heat of the sun for the maturation of fruits; yea, and the heat of vivification of living creatures; are both represented and supplied by the heat of fire; and likewise the heats of the sun, and life, are represented one by the other. Trees set upon the backs of chimneys do ripen fruit sooner. Vines that have been drawn in at the window of a kitchen, have sent forth grapes ripe a month at least before others. Stoves at the back of walls bring forth oranges here with us.

Eggs, as is reported by some, have been hatched in the warmth of an oven. It is reported by the ancients, that the ostrich[1] layeth her eggs under sand, where the heat of the sun discloseth them.[2]

Experiment solitary touching swelling and dilatation in boiling.

857. Barley in the boiling swelleth not much; wheat swelleth more;[3] rice extremely; insomuch as a quarter of a pint (unboiled) will arise to a pint boiled. The cause (no doubt) is, for that the more close and compact the body is, the more it will dilate: now barley is the most hollow; wheat more solid than that; and rice most solid of all. It may be also that some bodies have a kind of lentour, and more depertible nature than others; as we see it evident in coloration; for a small quantity of saffron will tinct more than a very great quantity of brasil or wine.

Experiment solitary touching the dulcoration of fruits.

858. Fruit groweth sweet by rolling, or pressing them gently with the hand; as rolling pears, damascenes, &c.: by rottenness; as medlars, services, sloes, heps, &c.: by time; as apples, wardens, pomegranates,

[1] *Estrich* in the original. — *J. S.*

[2] Conrad Gesner, who is very learned in all writers on natural history, refers for this statement to Albertus Magnus, who gives no ancient authority for it, and I have not been able to find any. The notion that the ostrich hatches her eggs by looking at them, Gesner quotes from Cælius Rhodiginus. See his *Hist. Animal.* iii. p. 711. As she is commonly taxed with want of solicitude about her offspring, it is worth mentioning that Ælian speaks of a cruel method of catching the ostrich; namely, putting a cheval de frise of spikes round her nest, on which she impales herself in endeavouring to return to her young.

[3] Arist. Prob. xxi. 22.

&c.: by certain special maturations; as by laying them in hay, straw, &c.: and by fire; as in roasting, stewing, baking, &c. The cause of the sweetness by rolling and pressing, is emollition, which they properly induce; as in beating of stock-fish, flesh, &c.: by rottenness, is for that the spirits of the fruit by putrefaction gather heat, and thereby digest the harder part; for in all putrefactions there is a degree of heat: by time and keeping, is because the spirits of the body do ever feed upon the tangible parts, and attenuate them: by several maturations is, by some degree of heat: and by fire is, because it is the proper work of heat to refine and to incorporate; and all sourness consisteth in some grossness of the body; and all incorporation doth make the mixture of the body more equal in all the parts; which ever induceth a milder taste.

Experiment solitary touching flesh edible and not edible.

859. Of fleshes, some are edible; some, except it be in famine, not. For those that are not edible, the cause is, for that they have commonly too much bitterness of taste; and therefore those creatures which are fierce and choleric are not edible; as lions, wolves, squirrels, dogs, foxes, horses, &c. As for kine, sheep, goats, deer, swine, coneys, hares, &c., we see they are mild and fearful. Yet it is true that horses, which are beasts of courage, have been and are eaten by some nations; as the Scythians were called Hippophagi; and the Chineses eat horse-flesh at this day; and some gluttons have used to have colts'-flesh baked. In birds, such as are carnivoræ, and birds of prey, are commonly no good meat; but the reason is rather the choleric nature of those birds, than their feeding upon flesh:

for puets, gulls, shovellers, ducks, do feed upon flesh, and yet are good meat; and we see that those birds which are of prey, or feed upon flesh, are good meat when they are very young; as hawks, rooks out of the nest, owls, &c. Man's flesh is not eaten. The reasons are three: first, because men in humanity do abhor it: secondly, because no living creature that dieth of itself is good to eat: and therefore the cannibals themselves eat no man's-flesh of those that die of themselves, but of such as are slain: the third is, because there must be generally some disparity between the nourishment and the body nourished; and they must not be over-near, or like: yet we see that in great weaknesses and consumptions, men have been sustained with woman's milk; and Ficinus fondly (as I conceive) adviseth, for the prolongation of life, that a vein be opened in the arm of some wholesome young man, and the blood to be sucked.[1] It is said that witches do greedily eat man's flesh; which if it be true, besides a devilish appetite in them, it is likely to proceed for that man's flesh may send up high and pleasing vapours, which may stir the imagination; and witches' felicity is chiefly in imagination, as hath been said.

Experiment solitary touching the salamander.

860. There is an ancient received tradition of the salamander, that it liveth in the fire, and hath force also to extinguish the fire. It must have two things, if it be true, to this operation: the one a very close skin, whereby flame, which in the midst is not so hot, cannot enter; for we see that if the palm of the hand be anointed thick with white of egg, and then aqua vitæ

[1] Ficinus, De vitâ producendâ, ii. 11.

be poured upon it and inflamed, yet one may endure the flame a pretty while. The other is some extreme cold and quenching virtue in the body of that creature, which choketh the fire. We see that milk quencheth wild-fire better than water, because it entereth better.

Experiment solitary touching the contrary operations of time upon fruits and liquors.

861. Time doth change fruit, (as apples, pears, pomegranates, &c.) from more sour to more sweet: but contrariwise liquors, (even those that are of the juice of fruit,) from more sweet to more sour; as wort, must, new verjuice, &c. The cause is, the congregation of the spirits together: for in both kinds the spirit is attenuated by time; but in the first kind it is more diffused, and more mastered by the grosser parts, which the spirits do but digest; but in drinks the spirits do reign, and finding less opposition of the parts, become themselves more strong; which causeth also more strength in the liquor; such as if the spirits be of the hotter sort, the liquor becometh apt to burn: but in time it causeth likewise, when the higher spirits are evaporated, more sourness.

Experiment solitary touching blows and bruises.

862. It hath been observed by the ancients that plates of metal, and especially of brass, applied presently to a blow, will keep it down from swelling.[1] The cause is repercussion, without humectation or entrance of any body: for the plate hath only a virtual cold, which doth not search into the hurt; whereas all plaisters and ointments do enter. Surely the cause that

[1] Arist. Prob. ix. 10.

blows and bruises induce swellings is, for that the spirits resorting to succour the part that laboureth, draw also the humours with them; for we see that it is not the repulse and the return of the humour in the part strucken that causeth it; for that gouts and tooth-aches cause swelling, where there is no percussion at all.

Experiment solitary touching the orrice root.

863. The nature of the orrice root is almost singular; for there are but few odoriferous roots; and in those that are in any degree sweet, it is but the same sweetness with the wood or leaf: but the orrice is not sweet in the leaf: neither is the flower anything so sweet as the root. The root seemeth to have a tender dainty heat; which when it cometh above ground to the sun and the air, vanisheth: for it is a great mollifier: and hath a smell like a violet.

Experiment solitary touching the compression of liquors.

864. It hath been observed by the ancients that a great vessel full, drawn into bottles, and then the liquor put again into the vessel, will not fill the vessel again so full as it was, but that it may take in more liquor: and that this holdeth more in wine than in water.[1] The cause may be trivial; namely, by the expence of the liquor, in regard some may stick to the sides of the bottles: but there may be a cause more subtile; which is, that the liquor in the vessel is not so much compressed as in the bottle; because in the vessel the liquor meeteth with liquor chiefly; but

[1] Arist. Prob. xxv. 8. For the statements in the next two paragraphs, see the third and eighteenth problems in the same section.

in the bottles a small quantity of liquor meeteth with the sides of the bottles, which compress it so that it doth not open again.

Experiment solitary touching the working of water upon air contiguous.

865. Water being contiguous with air, cooleth it, but moisteneth it not, except it vapour. The cause is, for that heat and cold have a virtual transition, without communication of substance; but moisture not: and to all madefaction there is required an imbibition: but where the bodies are of such several levity and gravity as they mingle not, there can follow no imbibition. And therefore oil likewise lieth at the top of the water, without commixture: and a drop of water running swiftly over a straw, or smooth body, wetteth not.

Experiment solitary touching the nature of air.

866. Star-light nights, yea, and bright moonshine nights, are colder than cloudy nights. The cause is, the dryness and fineness of the air, which thereby becometh more piercing and sharp; and therefore great continents are colder than islands: and as for the moon, though itself inclineth the air to moisture, yet when it shineth bright, it argueth the air is dry. Also close air is warmer than open air; which (it may be) is, for that the true cause of cold is an expiration from the globe of the earth, which in open places is stronger; and again, air itself, if it be not altered by that expiration, is not without some secret degree of heat; as it is not likewise without some secret degree of light; for otherwise cats and owls could not see in the night, but that air hath a little

light, proportionable to the visual spirits of those creatures.

Experiments in consort touching the eyes and sight.[1]

867. The eyes do move one and the same way; for when one eye moveth to the nostril, the other moveth from the nostril. The cause is motion of consent, which in the spirits and parts spiritual is strong. But yet use will induce the contrary: for some can squint when they will; and the common tradition is, that if children be set upon a table with a candle behind them, both eyes will move outwards, as affecting to see the light, and so induce squinting.

868. We see more exquisitely with one eye shut, than with both open. The cause is, for that the spirits visual unite themselves more, and so become stronger. For you may see by looking in a glass, that when you shut one eye, the pupil of the other eye that is open dilateth.

869. The eyes, if the sight meet not in one angle, see things double. The cause is, for that seeing two things, and seeing one thing twice, worketh the same effect; and therefore a little pellet held between two fingers laid across, seemeth double.

870. Pore-blind men see best in the dimmer lights; and likewise have their sight stronger near hand, than those that are not pore-blind; and can read and write smaller letters. The cause is, for that the spirits visual, in those that are pore-blind, are thinner and rarer than in others; and therefore the greater light disperseth them. For the same cause they need contracting; but

[1] The statements in these paragraphs, to 872. inclusive, are taken from Arist. Prob. xxxi. 7. 2. 11. 15. 26. 29. and 3.

being contracted, are more strong than the visual spirits of ordinary eyes are; as when we see through a level the sight is the stronger; and so is it when you gather the eye-lids somewhat close; and it is commonly seen in those that are pore-blind, that they do much gather the eye-lids together. But old men, when they would see to read, put the paper somewhat afar off; the cause is, for that old men's spirits visual, contrary to those of pore-blind men, unite not but when the object is at some good distance from their eyes.

871. Men see better, when their eyes are over against the sun or a candle, if they put their hand a little before their eyes. The reason is, for that the glaring of the sun or the candle doth weaken the eye; whereas the light circumfused is enough for the perception. For we see that an over-light maketh the eyes dazzle; insomuch as perpetual looking against the sun would cause blindness. Again, if men come out of a great light into a dark room; and contrariwise, if they come out of a dark room into a light room; they seem to have a mist before their eyes, and see worse than they shall do after they have stayed a little while either in the light or in the dark. The cause is, for that the spirits visual are, upon a sudden change, disturbed and put out of order; and till they be recollected, do not perform their function well. For when they are much dilated by light, they cannot contract suddenly; and when they are much contracted by darkness, they cannot dilate suddenly. And excess of both these (that is, of the dilatation and contraction of the spirits visual), if it be long, destroyeth the eye. For as long looking against the sun or fire hurteth the eye by dilatation; so curious painting in

small volumes, and reading of small letters, do hurt the eye by contraction.

872. It hath been observed that in anger the eyes wax red; and in blushing, not the eyes, but the ears, and the parts behind them. The cause is, for that in anger the spirits ascend and wax eager; which is most easily seen in the eyes, because they are translucid; though withal it maketh both the cheeks and the gills red; but in blushing, it is true the spirits ascend likewise to succour both the eyes and the face, which are the parts that labour; but then they are repulsed by the eyes, for that the eyes, in shame, do put back the spirits that ascend to them, as unwilling to look abroad: for no man in that passion doth look strongly, but dejectedly; and that repulsion from the eyes diverteth the spirits and heat more to the ears, and the parts by them.

873. The objects of the sight may cause a great pleasure and delight in the spirits, but no pain or great offence; except it be by memory, as hath been said. The glimpses and beams of diamonds that strike the eye; Indian feathers, that have glorious colours; the coming into a fair garden; the coming into a fair room richly furnished; a beautiful person; and the like; do delight and exhilarate the spirits much. The reason why it holdeth not in the offence is, for that the sight is the most spiritual of the senses; whereby it hath no object gross enough to offend it. But the cause (chiefly) is, for that there be no active objects to offend the eye. For harmonical sounds and discordant sounds are both active and positive: so are sweet smells and stinks: so are bitter and sweet in tastes: so are over-hot and over-cold in touch: but blackness and dark-

ness are indeed but privatives; and therefore have little or no activity. Somewhat they do contristate, but very little.

Experiment solitary touching the colour of the sea or other water.

874. Water of the sea, or otherwise, looketh blacker when it is moved, and whiter when it resteth.[1] The cause is, for that by means of the motion, the beams of light pass not straight, and therefore must be darkened: whereas, when it resteth, the beams do pass straight. Besides, splendour hath a degree of whiteness; especially if there be a little repercussion: for a looking-glass with the steel behind, looketh whiter than glass simple. This experiment deserveth to be driven further, in trying by what means motion may hinder sight.

Experiment solitary touching shell-fish.

875. Shell-fish have been by some of the ancients compared and sorted with the insecta;[2] but I see no reason why they should; for they have male and female as other fish have: neither are they bred of putrefaction; especially such as do move. Nevertheless it is certain that oysters and cockles and mussles, which move not, have no discriminate sex. *Quære*, in what time, and how they are bred? It seemeth that shells of oysters are bred where none were before; and it is tried, that the great horse-mussle with the fine shell,

[1] Arist. Prob. xxiii. 23.

[2] I believe Aristotle is alluded to. He divides the Exsanguia into four classes, of which shell-fish form one, and insects another. See Arist. De Part. Animal. iv. 5. 1.; and compare Cardan, De Rer. Variet.

that breedeth in ponds, hath bred within thirty years: but then, which is strange, it hath been tried, that they do not only gape and shut as the oysters do, but remove from one place to another.

Experiment solitary touching the right side and the left.

876. The senses are alike strong both on the right side and on the left; but the limbs on the right side are stronger.[1] The cause may be, for that the brain, which is the instrument of sense, is alike on both sides; but motion and abilities of moving are somewhat holpen from the liver, which lieth on the right side. It may be also, for that the senses are put in exercise indifferently on both sides from the time of our birth; but the limbs are used most on the right side, whereby custom helpeth; for we see that some are left-handed; which are such as have used the left hand most.

Experiment solitary touching frictions.[2]

877. Frictions make the parts more fleshy and full; as we see both in men, and in currying of horses, &c. The cause is, for that they draw greater quantity of spirits and blood to the parts: and again, because they draw the aliment more forcibly from within: and again, because they relax the pores, and so make better passage for the spirits, blood, and aliment: lastly, because they dissipate and digest any inutile or excrementitious moisture which lieth in the flesh; all which help assimilation. Frictions also do more fill and impinguate the body, than exercise. The cause is, for that in frictions the inward parts are at

[1] Arist. Prob. xxxi. 13. Hippocrates asserts the contrary.
[2] See Arist. Prob. xxxvii. 3. and 6.

rest; which in exercise are beaten (many times) too much: and for the same reason (as we have noted heretofore) galley-slaves are fat and fleshy, because they stir the limbs more, and the inward parts less.

Experiment solitary touching globes appearing flat at distance.

878. All globes afar off appear flat.[1] The cause is, for that distance, being a secondary object of sight, is not otherwise discerned than by more or less light: which disparity when it cannot be discerned, all seemeth one: as it is (generally) in objects not distinctly discerned; for so letters, if they be so far off as they cannot be discerned, shew but as a duskish paper; and all engravings and embossings (afar off) appear plain.

Experiment solitary touching shadows.

879. The utmost parts of shadows seem ever to tremble.[2] The cause is, for that the little motes which we see in the sun do ever stir, though there be no wind; and therefore those moving, in the meeting of the light and the shadow, from the light to the shadow, and from the shadow to the light, do shew the shadow to move, because the medium moveth.

Experiment solitary touching the rolling and breaking of the seas.

880. Shallow and narrow seas break more than deep

[1] Aristotle (Prob. xvi. 7.) remarks this in the case of the sun and moon. That a luminous globe appears uniformly bright, shows that the intensity with which light radiates varies as the sine of the angle its direction makes with a normal to the radiating surface. Were this not the case, the brightness would increase indefinitely from the centre towards the circumference.

[2] Arist. Prob. xvi. 12.

and large.[1] The cause is, for that, the impulsion being the same in both, where there is greater quantity of water, and likewise space enough, there the water rolleth and moveth both more slowly and with a sloper rise and fall: but where there is less water, and less space, and the water dasheth more against the bottom, there it moveth more swiftly, and more in precipice; for in the breaking of the waves there is ever a precipice.

Experiment solitary touching the dulcoration of salt water.

881. It hath been observed by the ancients that salt water boiled, or boiled and cooled again, is more potable than of itself raw: and yet the taste of salt in distillations by fire riseth not; for the distilled water will be fresh. The cause may be, for that the salt part of the water doth partly rise into a kind of scum on the top, and partly goeth into a sediment in the bottom; and so is rather a separation than an evaporation. But it is too gross to rise into a vapour: and so is a bitter taste likewise; for simple distilled waters, of wormwood and the like, are not bitter.

Experiment solitary touching the return of saltness in pits upon the sea-shore.

882. It hath been set down before, that pits upon the sea-shore turn into fresh water, by percolation of the salt through the sand: but it is further noted by some of the ancients that in some places of Africk,

[1] Arist. Prob. xxiii. 1. And see the eighteenth, twentieth, and twenty-first problems of the same section for the statements in the next three paragraphs.

after a time, the water in such pits will become brackish again. The cause is, for that after a time the very sands through which the salt water passeth become salt; and so the strainer itself is tincted with salt. The remedy therefore is, to dig still new pits, when the old wax brackish; as if you would change your strainer.

Experiment solitary touching attraction by similitude of substance.

883. It hath been observed by the ancients that salt water will dissolve salt put into it, in less time than fresh water will dissolve it. The cause may be, for that the salt in the precedent water doth, by similitude of substance, draw the salt new put in unto it; whereby it diffuseth in the liquor more speedily. This is a noble experiment, if it be true; for it sheweth means of more quick and easy infusions; and it is likewise a good instance of attraction by similitude of substance. Try it with sugar put into water formerly sugared, and into other water unsugared.

Experiment solitary touching attraction.

884. Put sugar into wine, part of it above, part under the wine; and you shall find (that which may seem strange) the sugar above the wine will soften and dissolve sooner than that within the wine. The cause is, for that the wine entereth that part of the sugar which is under the wine by simple infusion or spreading; but that part above the wine is likewise forced by sucking; for all spungy bodies expel the air and draw in liquor, if it be contiguous: as we see it also in spunges put part above the water. It

is worthy the inquiry, to see how you may make more accurate infusions by help of attraction.

Experiment solitary touching heat under earth.

885. Water in wells is warmer in winter than in summer; and so air in caves. The cause is, for that in the hither parts, under the earth, there is a degree of some heat (as appeareth in sulphureous veins, &c.); which shut close in (as in winter) is the more; but if it perspire (as it doth in summer), it is the less.

Experiment solitary touching flying in the air.

886. It is reported that amongst the Leucadians,[1] in ancient time, upon a superstition, they did use to precipitate a man from a high cliff into the sea; tying about him with strings, at some distance, many great fowls; and fixing unto his body divers feathers, spread, to break the fall.[2] Certainly many birds of good wing (as kites, and the like,) would bear up a good weight as they fly; and spreading of feathers thin, and close and in great breadth, will likewise bear up a great weight; being even laid, without tilting upon the sides. The further extension of this experiment for flying may be thought upon.

Experiment solitary touching the dye of scarlet.

887. There is in some places, (namely in Cephalonia) a little shrub which they call holy-oak, or dwarf-oak; upon the leaves whereof there riseth a tumour like a blister; which they gather, and rub out of it a certain red dust, that converteth (after a while) into

[1] *Leucacians* in the original. — *J. S.*

[2] This story is mentioned by Sandys, p. 4.

worms, which they kill with wine, (as is reported,) when they begin to quicken: with this dust they dye scarlet.[1]

Experiment solitary touching maleficiating.

888. In Zant it is very ordinary to make men impotent to accompany with their wives. The like is practised in Gascony; where it is called *nouër l'eguillette.* It is practised always upon the wedding-day. And in Zant the mothers themselves do it, by way of prevention; because thereby they hinder other charms, and can undo their own.[2] It is a thing the civil law taketh knowledge of; and therefore is of no light regard.

Experiment solitary touching the rise of water by means of flame.

889. It is a common experiment, but the cause is mistaken. Take a pot, (or better a glass, because therein you may see the motion,) and set a candle lighted in the bottom of a bason of water; and turn the mouth of the pot or glass over the candle; and it will make the water rise. They ascribe it to the drawing of heat; which is not true: for it appeareth plainly to be but a motion of *nexe*, which they call *ne detur vacuum;* and it proceedeth thus. The flame of the candle, as soon as it is covered, being suffocated by the close air, lesseneth by little and little: during which time there is some little ascent of water, but not much: for the flame occupying less and less room, as it lesseneth, the water succeedeth. But upon the instant of the candle's going out, there is a sudden rise of a great deal of water: for that the body of the flame filleth no

[1] Sandys, ubi supra. [2] Id. p. 6.

more place, and so the air and the water succeed. It worketh the same effect, if instead of water you put flour or sand into the bason: which sheweth that it is not the flame's drawing the liquor, as nourishment; as it is supposed; for all bodies are alike unto it; as it is ever in motion of nexe; insomuch as I have seen the glass, being held by the hand, hath lifted up the bason and all; the motion of nexe did so clasp the bottom of the bason. That experiment, when the bason was lifted up, was made with oil, and not with water: nevertheless this is true, that at the very first setting of the mouth of the glass upon the bottom of the bason, it draweth up the water a little, and then standeth at a stay, almost till the candle's going out, as was said. This may shew some attraction at first: but of this we will speak more, when we handle attractions by heat.

Experiments in consort touching the influences of the moon.

Of the power of the celestial bodies, and what more secret influences they have besides the two manifest influences of heat and light, we shall speak when we handle experiments touching the celestial bodies: meanwhile we will give some directions for more certain trials of the virtue and influences of the moon; which is our nearest neighbour.

The influences of the moon (most observed) are four. The drawing forth of heat; the inducing of putrefaction; the increase of moisture; the exciting of the motions of spirits.

890. For the drawing forth of heat, we have for-

merly prescribed to take water warm, and to set part of it against the moon-beams, and part of it with a screen between; and to see whether that which standeth exposed to the beams will not cool sooner. But because this is but a small interposition, (though in the sun we see a small shade doth much,) it were good to try it when the moon shineth, and when the moon shineth not at all; and with water warm in a glass bottle, as well as in a dish; and with cinders; and with iron red-hot, &c.

891. For the inducing of putrefaction, it were good to try it with flesh or fish exposed to the moon-beams, and again exposed to the air when the moon shineth not, for the like time; to see whether will corrupt sooner: and try it also with capon, or some other fowl, laid abroad, to see whether it will mortify and become tender sooner; try it also with dead flies, or dead worms, having a little water cast upon them, to see whether will putrefy sooner. Try it also with an apple or orange, having holes made in their tops, to see whether will rot or mould sooner. Try it also with Holland cheese, having wine put into it, whether will breed mites sooner or greater.

892. For the increase of moisture, the opinion received is that seeds will grow soonest; and hair, and nails, and hedges, and herbs cut, &c., will grow soonest; if they be set or cut in the increase of the moon. Also that brains in rabbits, woodcocks, calves, &c., are fullest in the full of the moon: and so of marrow in the bones; and so of oysters and cockles, which of all the rest are the easiest tried, if you have them in pits.

893. Take some seeds, or roots, (as onions, &c.)

and set some of them immediately after the change; and others of the same kind immediately after the full: let them be as like as can be; the earth also the same as near as may be; and therefore best in pots: let the pots also stand where no rain or sun may come to them, lest the difference of the weather confound the experiment: and then see in what time the seeds set in the increase of the moon come to a certain height; and how they differ from those that are set in the decrease of the moon.

894. It is like that the brain of man waxeth moister and fuller upon the full of the moon; and therefore it were good for those that have moist brains, and are great drinkers, to take fume of lignum aloës, rosemary, frankincense, &c., about the full of the moon. It is like also, that the humours in men's bodies increase and decrease as the moon doth; and therefore, it were good to purge some day or two after the full; for that then the humours will not replenish so soon again.

895. As for the exciting of the motion of the spirits, you must note that the growth of hedges, herbs, hair, &c. is caused from the moon, by exciting of the spirits as well as by increase of the moisture. But for spirits in particular, the great instance is in lunacies.

896. There may be other secret effects of the influence of the moon, which are not yet brought into observation. It may be, that if it so fall out that the wind be north, or north-east, in the full of the moon, it increaseth cold; and if south, or south-west, it disposeth the air for a good while to warmth and rain; which would be observed.

897. It may be, that children and young cattle that are brought forth in the full of the moon, are stronger

and larger than those that are brought forth in the wane; and those also which are begotten in the full of the moon: so that it might be good husbandry to put rams and bulls to their female somewhat before the full of the moon. It may be also, that the eggs laid in the full of the moon breed the better bird; and a number of the like effects which may be brought into observation. *Quære* also, whether great thunders and earthquakes be not most in the full of the moon.

Experiment solitary touching vinegar.

898. The turning of wine to vinegar is a kind of putrefaction: and in making of vinegar, they use to set vessels of wine over against the noon-sun; which calleth out the more oily spirits, and leaveth the liquor more sour and hard. We see also, that burnt wine is more hard and astringent than wine unburnt. It is said that cider, in navigations under the line, ripeneth, when wine or beer soureth. It were good to set a rundlet of verjuice over against the sun in summer, as they do vinegar, to see whether it will ripen and sweeten.

Experiment solitary touching creatures that sleep all winter.

899. There be divers creatures that sleep all winter; as the bear, the hedge-hog, the bat, the bee, &c. These all wax fat when they sleep, and egest not. The cause of their fattening during their sleeping time, may be the want of assimilating; for whatsoever assimilateth not to flesh, turneth either to sweat or fat. These creatures, for part of their sleeping time, have been observed not to stir at all; and for the other part,

to stir, but not to remove. And they get warm and close places to sleep in. When the Flemings wintered in Nova Zembla,[1] the bears about the middle of November went to sleep; and then the foxes began to come forth, which durst not before. It is noted by some of the ancients, that the she-bear breedeth, and lieth in with her[2] young, during that time of rest; and that a bear big with young hath seldom been seen.[3]

Experiment solitary touching the generating of creatures by copulation and by putrefaction.

900. Some living creatures are procreated by copulation between male and female; some by putrefaction: and of those which come by putrefaction, many do (nevertheless) afterwards procreate by copulation. For the cause of both generations: first, it is most certain that the cause of all vivification is a gentle and proportionable heat, working upon a glutinous and yielding substance: for the heat doth bring forth spirit in that substance; and the substance being glutinous produceth two effects; the one, that the spirit is detained, and cannot break forth; the other, that the matter being gentle and yielding, is driven forwards by the motion of the spirits, after some swelling, into shape and members. Therefore all sperm, all menstruous substance, all matter whereof creatures are produced by putrefaction, have evermore a closeness, lentour, and sequacity. It seemeth therefore, that the generation by sperm only, and by putrefaction, have

[1] In 1596–97. The bears disappeared after sunset, but there was no other reason for supposing that they became dormant.

[2] *Their* in the original. — *J. S.*

[3] Arist. Hist. Animal. vi. 30., and viii. 17.

two different causes. The first is, for that creatures which have a definite and exact shape (as those have which are procreated by copulation,) cannot be produced by a weak and casual heat; nor out of matter which is not exactly prepared according to the species. The second is, for that there is a greater time required for maturation of perfect creatures; for if the time required in vivification be of any length, then the spirit will exhale before the creature be mature; except it be enclosed in a place where it may have continuance of the heat, access of some nourishment to maintain it, and closeness that may keep it from exhaling: and such places are the wombs and matrices of the females.[1] And therefore all creatures made of putrefaction are of more uncertain shape; and are made in shorter time; and need not so perfect an inclosure, though some closeness be commonly required. As for the Heathen opinion, which was, that upon great mutations of the world, perfect creatures were first engendered of concretion; as well as frogs, and worms, and flies, and such like, are now;[2] we know it to be vain: but if any such thing should be admitted, discoursing according to sense, it cannot be, except you admit a chaos first, and commixture of heaven and earth. For the frame of the world, once in order, cannot effect it by any excess or casualty.

[1] Compare Telesius, De Rerum Naturâ, vi.
[2] Plut. De Placitis Philos. v. 19.

NATURAL HISTORY.

CENTURY X.

Experiments in consort touching transmission and influx of immateriate virtues, and the force of imagination.

THE philosophy of Pythagoras (which was full of superstition) did first plant a monstrous imagination; which afterwards was, by the school of Plato and others, watered and nourished. It was, that the world was one entire perfect living creature; insomuch as Apollonius of Tyana, a Pythagorean prophet, affirmed that the ebbing and flowing of the sea was the respiration of the world, drawing in water as breath, and putting it forth again.[1] They went on and inferred, that if the world were a living creature, it had a soul and spirit; which also they held, calling it *spiritus mundi*, the spirit or soul of the world: by which they did not intend God (for they did admit of a deity besides), but only the soul or essential form of the universe. This foundation being laid, they might build upon it what they

[1] Philostratus, Vit. Apollon. v. 1.

would; for in a living creature, though never so great, (as for example, in a great whale,) the sense and the affects of any one part of the body instantly make a transcursion throughout the whole body: so that by this they did insinuate, that no distance of place, nor want or indisposition of matter, could hinder magical operations; but that (for example) we might here in Europe have sense and feeling of that which was done in China; and likewise we might work any effect without and against matter; and this not holpen by the co-operation of angels or spirits, but only by the unity and harmony of nature. There were some also that stayed not here; but went further, and held that if the spirit of man (whom they call the microcosm) do give a fit touch to the spirit of the world by strong imaginations and beliefs, it might command nature; for Paracelsus, and some darksome authors of magic, do ascribe to imagination exalted, the power of miracle-working faith. With these vast and bottomless follies men have been (in part) entertained.

But we, that hold firm to the works of God, and to the sense, which is God's lamp, (*lucerna Dei spiraculum hominis*,) will inquire with all sobriety and severity, whether there be to be found in the footsteps of nature any such transmission and influx of immateriate virtues; and what the force of imagination is, either upon the body imaginant or upon another body; wherein it will be like that labour of

Hercules in purging the stable of Augeas, to separate from superstitious and magical arts and observations, any thing that is clean and pure natural, and not to be either contemned or condemned. And although we shall have occasion to speak of this in more places than one, yet we will now make some entrance thereinto.

Experiments in consort, monitory, touching transmission of spirits and the force of imagination.

901. Men are to be admonished that they do not withdraw credit from the operations by transmission of spirits and force of imagination, because the effects fail sometimes. For as in infection and contagion from body to body (as the plague and the like) it is most certain that the infection is received (many times) by the body passive, but yet is by the strength and good disposition thereof repulsed and wrought out, before it be formed into a disease; so much more in impressions from mind to mind, or from spirit to spirit, the impression taketh, but is encountered and overcome by the mind and spirit, which is passive, before it work any manifest effect. And therefore they work most upon weak minds and spirits; as those of women, sick persons, superstitious and fearful persons, children and young creatures.

Nescio quis teneros oculus mihi fascinat agnos.[1]

The poet speaketh not of sheep, but of lambs. As for the weakness of the power of them upon kings and magistrates, it may be ascribed (besides the main,

[1] Virg. Eclog. iii. 103.

which is the protection of God over those that execute his place) to the weakness of the imagination of the imaginant: for it is hard for a witch or a sorcerer to put on a belief that they can hurt such persons.

902. Men are to be admonished, on the other side, that they do not easily give place and credit to these operations, because they succeed many times. For the cause of this success is oft to be truly ascribed unto the force of affection and imagination upon the body agent; and then by a secondary means it may work upon a divers body: as for example, if a man carry a planet's seal, or a ring, or some part of a beast, believing strongly that it will help him to obtain his love, or to keep him from danger of hurt in fight, or to prevail in a suit, &c., it may make him more active and industrious, and again more confident and persisting, than otherwise he would be. Now the great effects that may come of industry and perseverance (especially in civil business) who knoweth not? For we see audacity doth almost bind and mate the weaker sort of minds; and the state of human actions is so variable, that to try things oft, and never to give over, doth wonders: therefore it were a mere fallacy and mistaking to ascribe that to the force of imagination upon another body, which is but the force of imagination upon the proper body; for there is no doubt but that imagination and vehement affection work greatly upon the body of the imaginant; as we shall shew in due place.

903. Men are to be admonished that, as they are not to mistake the causes of these operations, so much less they are to mistake the fact or effect; and rashly to take that for done which is not done. And there-

fore, as divers wise judges have prescribed and cautioned, men may not too rashly believe the confessions of witches, nor yet the evidence against them. For the witches themselves are imaginative, and believe oftimes they do that which they do not: and people are credulous in that point, and ready to impute accidents and natural operations to witchcraft. It is worthy the observing, that both in ancient and late times (as in the Thessalian witches, and the meetings of witches that have been recorded by so many late confessions) the great wonders which they tell, of carrying in the air, transforming themselves into other bodies, &c., are still reported to be wrought, not by incantations or ceremonies, but by ointments, and anointing themselves all over. This may justly move a man to think that these fables are the effects of imagination: for it is certain that ointments do all (if they be laid on any thing thick) by stopping of the pores, shut in the vapours, and send them to the head extremely. And for the particular ingredients of those magical ointments, it is like they are opiate and soporiferous. For anointing of the forehead, neck, feet, back-bone, we know is used for procuring dead sleeps: and if any man say that this effect would be better done by inward potions; answer may be made, that the medicines which go to the ointments are so strong, that if they were used inwards they would kill those that use them: and therefore they work potently, though outwards.

We will divide the several kinds of the operations by transmission of spirits and imagination; which will give no small light to the experiments that follow. All operations by transmission of

spirits and imagination, have this; that they work at distance, and not at touch; and they are these, being distinguished.

904. The first is the transmission or emission of the thinner and more airy parts of bodies; as in odours and infections; and this is, of all the rest, the most corporeal. But you must remember withal, that there be a number of those emissions, both wholesome and unwholesome, that give no smell at all: for the plague, many times, when it is taken, giveth no scent at all: and there be many good and healthful airs, that do appear by habitation and other proofs, that differ not in smell from other airs. And under this head you may place all imbibitions of air, where the substance is material, odour-like; whereof some nevertheless are strange, and very suddenly diffused; as the alteration which the air receiveth in Egypt, almost immediately, upon the rising of the river of Nilus, whereof we have spoken.

905. The second is the transmission or emission of those things that we call spiritual species: as visibles and sounds; the one whereof we have handled, and the other we shall handle in due place. These move swiftly, and at great distance; but then they require a medium well disposed, and their transmission is easily stopped.

906. The third is the emissions which cause attraction of certain bodies at distance; wherein though the loadstone be commonly placed in the first rank, yet we think good to except it, and refer it to another head: but the drawing of amber and jet, and other electric bodies; and the attraction in gold of the spirit of quicksilver, at distance; and the attraction of heat at distance; and that of fire to naphtha; and that of some

herbs to water, though at distance; and divers others; we shall handle, but yet not under this present title, but under the title of attraction in general.

907. The fourth is the emission of spirits, and immateriate powers and virtues, in those things which work by the universal configuration and sympathy of the world; not by forms, or celestial influxes (as is vainly taught and received), but by the primitive nature of matter, and the seeds of things. Of this kind is (as we yet suppose) the working of the loadstone, which is by consent with the globe of the earth: of this kind is the motion of gravity, which is by consent of dense bodies with the globe of the earth: of this kind is some disposition of bodies to rotation, and particularly from east to west: of which kind we conceive the main float and refloat of the sea is, which is by consent of the universe, as part of the diurnal motion. These immateriate virtues have this property differing from others; that the diversity of the medium hindereth them not; but they pass through all mediums; yet at determinate distances. And of these we shall speak, as they are incident to several titles.

908. The fifth is the emissions of spirits; and this is the principal in our intention to handle now in this place; namely, the operation of the spirits of the mind of man upon other spirits: and this is of a double nature; the operations of the affections, if they be vehement; and the operation of the imagination, if it be strong. But these two are so coupled, as we shall handle them together: for when an envious or amorous aspect doth infect the spirits of another, there is joined both affection and imagination.

909. The sixth is the influxes of the heavenly bodies,

besides those two manifest ones, of heat and light. But these we will handle, where we handle the celestial bodies and motions.

910.[1] The seventh is the operations of sympathy; which the writers of natural magic have brought into an art or precept: and it is this; that if you desire to super-induce any virtue or disposition upon a person, you should take the living creature in which that virtue is most eminent and in perfection: of that creature you must take the parts wherein that virtue chiefly is collocate: again, you must take those parts in the time and act when that virtue is most in exercise: and then you must apply it to that part of man wherein that virtue chiefly consisteth. As if you would super-induce courage and fortitude, take a lion or a cock: and take the heart, tooth, or paw of the lion; or the heart or spur of the cock: take those parts immediately after the lion or the cock have been in fight: and let them be worn on a man's heart or wrist. Of these and such like sympathies, we shall speak under this present title.

911. The eighth and last is an emission of immateriate virtues; such as we are a little doubtful to propound, it is so prodigious, but that it is so constantly avouched by many: and we have set it down as a law to ourselves, to examine things to the bottom; and not to receive upon credit, or reject upon improbabilities, until there hath passed a due examination. This is, the sympathy of individuals; for as there is a sympathy of species, so (it may be) there is a sympathy of individuals: that is, that in things, or the parts of things, that have been once contiguous or entire,

[1] Compare Porta, Nat. Mag. i. 12.

there should remain a transmission of virtue from the one to the other: as between the weapon and the wound. Whereupon is blazed abroad the operation of *unguentum teli:* and so of a piece of lard, or stick of elder, &c., that if part of it be consumed or putrefied, it will work upon the other part severed. Now we will pursue the instances themselves.

Experiments in consort touching emission of spirits in vapour or exhalation, odour-like.

912. The plague is many times taken without manifest sense, as hath been said. And they report that, where it is found, it hath a scent of the smell of a mellow apple; and (as some say) of May-flowers: and it is also received that smells of flowers that are mellow and luscious, are ill for the plague; as white lilies, cowslips, and hyacinths.

913. The plague is not easily received by such as continually are about them that have the plague; as keepers of the sick, and physicians: nor again by such as take antidotes, either inward, (as mithridate; juniper-berries; rue, leaf and seed, &c.,) or outward, (as angelica, zedoary, and the like, in the mouth; tar, galbanum, and the like, in perfume); nor again by old people, and such as are of a dry and cold complexion. On the other side, the plague taketh soonest hold of those that come out of a fresh air, and of those that are fasting, and of children; and it is likewise noted to go in a blood, more than to a stranger.

914. The most pernicious infection, next the plague, is the smell of the jail, when prisoners have been long and close and nastily kept; whereof we have had in our time experience twice or thrice; when both the

judges that sat upon the jail, and numbers of those that attended the business or were present, sickened upon it, and died. Therefore it were good wisdom, that in such cases the jail were aired before they be brought forth.[1]

915. Out of question, if such foul smells be made by art and by the hand, they consist chiefly of man's flesh or sweat putrefied; for they are not those stinks which the nostrils straight abhor and expel, that are most pernicious; but such airs as have some similitude with man's body; and so insinuate themselves, and betray the spirits. There may be great danger in using such compositions, in great meetings of people within houses; as in churches, at arraignments, at plays and solemnities, and the like: for poisoning of air is no less dangerous than poisoning of water, which hath been used by the Turks in the wars, and was used by Emmanuel Comnenus towards the Christians, when they passed through his country to the Holy Land.[2] And these empoisonments of air are the more dangerous in meetings of people, because the much breath of people doth further the reception of the infection; and therefore, where any such thing is feared, it were good those public places were perfumed, before the assemblies.

916. The empoisonment of particular persons by odours, hath been reported to be in perfumed gloves, or the like: and it is like they mingle the poison that

[1] A memorable instance of what Bacon here mentions took place in 1750, in consequence of a neglected state of Newgate.

[2] I have not been able to find any authority for this statement. All the original historians of the second Crusade speak of the treachery of Comnenus, but no one charges him with having poisoned the wells. Nicetas affirms that in order to poison the Crusaders, lime was put into the flour with which they were supplied. He does not, however, assert that this was done by the emperor's direction.

is deadly, with some smells that are sweet, which also maketh it the sooner received. Plagues also have been raised by anointings of the chinks of doors, and the like;[1] not so much by the touch, as for that it is common for men, when they find any thing wet upon their fingers, to put them to their nose; which men therefore should take heed how they do. The best is, that these compositions of infectious airs cannot be made without danger of death to them that make them. But then again, they may have some antidotes to save themselves; so that men ought not to be secure of it.

917. There have been in divers countries great plagues, by the putrefaction of great swarms of grasshoppers and locusts, when they have been dead and cast upon heaps.

918. It happeneth oft in mines, that there are damps which kill, either by suffocation, or by the poisonous nature of the mineral: and those that deal much in refining, or other works about metals and minerals, have their brains hurt and stupefied by the metalline vapours. Amongst which it is noted that the spirits of quicksilver either fly to the skull, teeth, or bones; insomuch as gilders use to have a piece of gold in their mouth, to draw the spirits of quicksilver; which gold afterwards they find to be whitened. There are also certain lakes and pits, such as that of Avernus,

[1] See on this subject Manzoni's *Storia della Colonna infame*. In 1630 many persons at Milan were tortured and put to death in consequence of a popular belief that the plague, which raged in that year, had been raised in the manner mentioned in the text. For an earlier instance of the same belief, see Wierus *De Præstigiis Dæmonum*. It seems to be of recent origin, as, although the Jews were charged with producing the great plague of the fourteenth century, I have not met with any mention of their having been supposed to do so by poisonous anointings.

that poison birds (as is said) which fly over them or men that stay too long about them.

919. The vapour of charcoal, or sea-coal, in a close room, hath killed many; and it is the more dangerous, because it cometh without any ill smell, but stealeth on by little and little, inducing only a faintness, without any manifest strangling. When the Dutchmen wintered at Nova Zembla, and that they could gather no more sticks, they fell to make fire of some sea-coal they had, wherewith (at first) they were much refreshed; but a little after they had sat[1] about the fire, there grew a general silence and lothness to speak amongst them; and immediately after, one of the weakest of the company fell down in a swoon; whereupon they doubting what it was, opened their door to let in air, and so saved themselves. The effect (no doubt) is wrought by the inspissation of the air; and so of the breath and spirits. The like ensueth in rooms newly plastered, if a fire be made in them; whereof no less man than the Emperor Jovinianus died.[2]

920. Vide the experiment 803., touching the infectious nature of the air, upon the first showers after long drought.

921. It hath come to pass that some apothecaries, upon stamping of coloquintida, have been put into a great scouring by the vapour only.

922. It hath been a practice to burn a pepper they

[1] *Sit* in the original. — *J. S.*

[2] Ammianus Marcellinus mentions three causes which had been assigned for the death of Jovianus, whom Bacon calls Jovinianus, — one being a tumour in the head arising from exposure to a large fire. It does not seem therefore that he was suffocated. (Ammianus Marcel. xxv. sub fin.) I may remark that there appears to be no good foundation for the common anecdote that Philip the Third of Spain died from a similar cause.

call Ginny-pepper;[1] which hath such a strong spirit, that it provoketh a continual sneezing in those that are in the room.

923. It is an ancient tradition that blear-eyes infect sound eyes; and that a menstruous woman looking upon a glass, doth rust it:[2] nay, they have an opinion which seemeth fabulous; that menstruous women going over a field or garden, do corn and herbs good by killing the worms.[3]

924. The tradition is no less ancient, that the basilisk killeth by aspect; and that the wolf, if he see a man first, by aspect striketh a man hoarse.[4]

925. Perfumes convenient do dry and strengthen the brain, and stay rheums and defluxions; as we find in fume of rosemary dried, and lignum aloës, and calamus, taken at the mouth and nostrils: and no doubt there be other perfumes that do moisten and refresh, and are fit to be used in burning agues, consumptions, and too much wakefulness: such as are rose-water, vinegar, lemon-pills, violets, the leaves of vines sprinkled with a little rose-water, &c.

926. They do use in sudden faintings and swoonings to put a handkerchief with rose-water, or a little vinegar, to the nose; which gathereth together again the spirits, which are upon point to resolve and fall away.

927. Tobacco comforteth the spirits, and dischargeth weariness; which it worketh partly by opening; but chiefly by the opiate virtue, which condenseth the spirits. It were good therefore to try the taking of fumes by pipes (as they do in tobacco) of other things; as

[1] Guiana pepper, *i. e.* red pepper? Guinea pigs ought, it is said, to be called Guiana pigs. They are natives, not of Africa, but of America.

[2] Arist. Prob. vii. 4., and De Insomniis, 2.

[3] Pliny. xxviii. 23.

[4] Ib. viii. 33. and 34.

well to dry and comfort, as for other intentions. I wish trial be made of the drying fume of rosemary, and lignum aloës, before-mentioned, in pipe; and so of nutmeg, and folium indum, &c.

928. The following of the plough hath been approved for refreshing the spirits and procuring appetite;[1] but to do it in the ploughing for wheat or rye, is not so good; because the earth hath spent her sweet breath in vegetables put forth in summer. It is better therefore to do it when you sow barley. But because ploughing is tied to seasons, it is best to take the air of the earth new turned up, by digging with the spade, or standing by him that diggeth. Gentlewomen may do themselves much good by kneeling upon a cushion and weeding. And these things you may practise in the best seasons; which is ever the early spring, before the earth putteth forth the vegetables; and in the sweetest earth you can choose. It would be done also when the dew is a little off the ground, lest the vapour be too moist. I knew a great man that lived long, who had a clean clod of earth brought to him every morning as he sate in his bed: and he would hold his head over it a good pretty while. I commend also, sometimes, in digging of new earth, to pour in some Malmsey or Greek[2] wine; that the vapour of the earth and wine together may comfort the spirits the more; provided always it be not taken for a heathen sacrifice, or libation to the earth.

[1] It is difficult to say to what the good effect, if it exists, is to be ascribed; as the air contained in the interstices of vegetable mould contains much more than the usual proportion of carbonic acid gas, and a smaller proportion of oxygen.

[2] The name Malmsey has been given to wine grown in various places, but the original Malmsey came from Malvisia in the Morea. Malmsey is of course a corruption from Malvisia.

929. They have, in physic, use of pomanders, and knots of powders, for drying of rheums, comforting of the heart, provoking of sleep, &c. For though those things be not so strong as perfumes, yet you may have them continually in your hand; whereas perfumes you can take but at times; and besides, there be divers things that breathe better of themselves, than when they come to the fire; as nigella romana, the seed of melanthium, amomum, &c.

930. There be two things which (inwardly used) do cool and condense the spirits; and I wish the same to be tried outwardly in vapours. The one is nitre, which I would have dissolved in Malmsey, or Greek wine, and so the smell of the wine taken; or if you would have it more forcible, pour of it upon a fire-pan, well heated, as they do rose-water and vinegar. The other is the distilled water of wild poppy, which I wish to be mingled, at half, with rose-water, and so taken with some mixture of a few cloves in a perfuming-pan. The like would be done with the distilled water of saffron flowers.

931. Smells of musk, and amber, and civet, are thought to further venereous appetite; which they may do by the refreshing and calling forth of the spirits.

932. Incense and nidorous smells (such as were of sacrifices) were thought to intoxicate the brain, and to dispose men to devotion: which they may do by a kind of sadness, and contristation of the spirits; and partly also by heating and exalting them. We see that amongst the Jews the principal perfume of the sanctuary was forbidden all common uses.[1]

[1] Exodus, xxx. 37.

933. There be some perfumes prescribed by the writers of natural magic, which procure pleasant dreams; and some others (as they say) that procure prophetical dreams; as the seeds of flax, fleawort, &c.

934. It is certain that odours do, in a small degree, nourish; especially the odour of wine: and we see men a hungered do love to smell hot bread. It is related that Democritus, when he lay a dying, heard a woman in the house complain that she should be kept from being at a feast and solemnity, (which she much desired to see,) because there would be a corpse in the house; whereupon he caused loaves of new bread to be sent for, and opened them, and poured a little wine into them; and so kept himself alive with the odour of them, till the feast was past.[1] I knew a gentleman that would fast (sometimes) three or four, yea five days, without meat, bread, or drink; but the same man used to have continually a great wisp of herbs that he smelled on: and amongst those herbs, some esculent herbs of strong scent; as onions, garlic, leeks, and the like.

935. They do use, for the accident of the mother,[2] to burn feathers and other things of ill odour; and by those ill smells the rising of the mother is put down.

936. There be airs which the physicians advise their patients to remove unto, in consumptions or upon recovery of long sicknesses: which (commonly) are plain champaigns, but grazing, and not overgrown

[1] See for this story Diogenes Laertius, ix. 343.

[2] Id est, hysteria. The use of the word mother in this sense appears to have arisen from a mistranslation of the Italian or Spanish *madre*, which represents the Latin *matrix*, as well as *mater*. Mother of pearl has probably a similar origin.

with heath or the like; or else timber-shades, as in forests and the like. It is noted also, that groves of bays do forbid pestilent airs; which was accounted a great cause of the wholesome air of Antiochia. There be also some soils that put forth odorate herbs of themselves; as wild thyme, wild marjoram, penny-royal, camomile; and in which the briar-roses smell almost like musk-roses; which no doubt are signs that do discover an excellent air.

937. It were good for men to think of having healthful air in their houses; which will never be if the rooms be low-roofed, or full of windows and doors; for the one maketh the air close, and not fresh; and the other maketh it exceeding unequal; which is a great enemy to health. The windows also should not be high up to the roof, (which is in use for beauty and magnificence,) but low. Also stone-walls are not wholesome; but timber is more wholesome; and especially brick. Nay, it hath been used by some with great success to make their walls thick, and to put a lay of chalk between the bricks, to take away all dampishness.

Experiment solitary touching the emissions of spiritual species which affect the senses.

938. These emissions (as we said before) are handled, and ought to be handled, by themselves under their proper titles; that is, visibles and audibles, each apart: in this place it shall suffice to give some general observations common to both. First, they seem to be incorporeal. Secondly, they work swiftly. Thirdly, they work at large distances. Fourthly, in curious varieties. Fifthly, they are not effective of any thing,

nor leave no work behind them; but are energies merely: for their working upon mirrors, and places of echo, doth not alter anything in those bodies: but it is the same action with the original, only repercussed. And as for the shaking of windows, or rarefying the air by great noises; and the heat caused by burning-glasses; they are rather concomitants of the audible and visible species, than the effects of them. Sixthly, they seem to be of so tender and weak a nature, as they affect only such a rare and attenuate substance as is the spirit of living creatures.

Experiments in consort touching emission of immateriate virtues from the minds and spirits of men, either by affections, or by imaginations, or by other impressions.

939. It is mentioned in some stories, that where children have been exposed, or taken away young from their parents, and that afterwards they have approached to their parents' presence, the parents (though they have not known them) have had a secret joy or other alteration thereupon.

940. There was an Egyptian soothsayer, that made Antonius believe that his genius (which otherwise was brave and confident) was, in the presence of Octavianus Cæsar, poor and cowardly: and therefore he advised him to absent himself as much as he could, and remove far from him. This soothsayer was thought to be suborned by Cleopatra, to make him live in Egypt, and other remote places from Rome.[1] Howsoever the conceit of a predominant or mastering spirit of one man over another is ancient, and received still, even in vulgar opinion.

[1] Plut. in Ant. p. 930.

941. There are conceits that some men, that are of an ill and melancholy nature, do incline the company into which they come to be sad and ill-disposed; and contrariwise, that others, that are of a jovial nature, do dispose the company to be merry and cheerful. And again, that some men are lucky to be kept company with and employed; and others unlucky. Certainly it is agreeable to reason, that there are at the least some light effluxions from spirit to spirit, when men are in presence one with another, as well as from body to body.

942. It hath been observed that old men who have loved young company and been conversant continually with them, have been of long life; their spirits (as it seemeth) being recreated by such company. Such were the ancient sophists and rhetoricians; which ever had young auditors and disciples; as Gorgias, Protagoras, Isocrates, &c., who lived till they were an hundred years old. And so likewise did many of the grammarians and school-masters; such as was Orbilius,[1] &c.

943. Audacity and confidence doth, in civil business, so great effects, as a man may reasonably doubt that, besides the very daring and earnestness and persisting and importunity, there should be some secret binding and stooping of other men's spirits to such persons.

944. The affections (no doubt) do make the spirits more powerful and active; and especially those affections which draw the spirits into the eyes: which are two: love, and envy, which is called *oculus malus*. As for love, the Platonists (some of them) go so far as to

[1] Sueton. De Illust. Grammat. c. 9.

hold that the spirit of the lover doth pass into the spirits of the person loved;[1] which causeth the desire of return into the body whence it was emitted: whereupon followeth that appetite of contact and conjunction which is in lovers. And this is observed likewise, that the aspects that procure love, are not gazings, but sudden glances and dartings of the eye. As for envy, that emitteth some malign and poisonous spirit, which taketh hold of the spirit of another; and is likewise of greatest force when the cast of the eye is oblique. It hath been noted also, that it is most dangerous when an envious eye is cast upon persons in glory and triumph and joy: the reason whereof is, for that at such times the spirits come forth most into the outward parts, and so meet the percussion of the envious eye more at hand: and therefore it hath been noted, that after great triumphs, men have been ill-disposed for some days following. We see the opinion of fascination is ancient, for both effects: of procuring love, and sickness caused by envy: and fascination is ever by the eye. But yet if there be any such infection from spirit to spirit, there is no doubt but that it worketh by presence, and not by the eye alone; yet most forcibly by the eye.

945. Fear and shame are likewise infective; for we see that the starting of one will make another ready to start: and when one man is out of countenance in a company, others do likewise blush in his behalf.

Now we will speak of the force of imagination

[1] *τὴν ψυχὴν, Ἀγάθωνα φίλων, ἐπὶ χείλεσιν ἔσχον·*
ἦλθε γὰρ ἡ τλήμων ὡς διαβησομένη.
PLATO, ap. Aul. Gellium.

upon other bodies, and of the means to exalt and strengthen it. Imagination in this place I understand to be, the representation of an individual thought. Imagination, is of three kinds: the first joined with belief of that which is to come: the second joined with memory of that which is past: and the third is of things present, or as if they were present; for I comprehend in this, imaginations feigned and at pleasure; as if one should imagine such a man to be in the vestments of a Pope, or to have wings. I single out, for this time, that which is with faith or belief of that which is to come. The inquisition of this subject in our way (which is by induction) is wonderful hard: for the things that are reported are full of fables; and new experiments can hardly be made but with extreme caution, for the reason which we will hereafter declare.

The power of imagination is in three kinds: the first upon the body of the imaginant, including likewise the child in the mother's womb; the second is, the power of it upon dead bodies, as plants, wood, stone, metal, &c.; the third is, the power of it upon the spirits of men and living creatures: and with this last we will only meddle.

The problem therefore is, whether a man constantly and strongly believing that such a thing shall be, (as that such an one will love him, or that such an one will grant him his request, or that

such an one shall recover a sickness, or the like,) it doth help any thing to the effecting of the thing itself. And here again we must warily distinguish; for it is not meant (as hath been partly said before) that it should help by making a man more stout, or more industrious; (in which kind constant belief doth much;) but merely by a secret operation, or binding, or changing the spirit of another: and in this it is hard (as we began to say) to make any new experiment; for I cannot command myself to believe what I will, and so no trial can be made. Nay, it is worse; for whatsoever a man imagineth doubtingly, or with fear, must needs do hurt, if imagination have any power at all; for a man representeth that oftener that he feareth, than the contrary.

The help therefore is, for a man to work by another, in whom he may create belief, and not by himself; until himself have found by experience, that imagination doth prevail; for then experience worketh in himself belief; if the belief that such a thing shall be, be joined with a belief that his imagination may procure it.

946. For example: I related one time to a man that was curious and vain enough in these things, that I saw a kind of juggler, that had a pair of cards, and would tell a man what card he thought. This pretended learned man told me it was a mistaking in me; "for," said he, "it was not the knowledge of the man's

thought, (for that is proper to God,) but it was the enforcing of a thought upon him, and binding his imagination by a stronger, that he could think no other card." And thereupon he asked me a question or two, which I thought he did but cunningly, knowing before what used to be the feats of the juggler. "Sir," said he, "do you remember whether he told the card the man thought, himself, or bade another to tell it?" I answered (as was true) that he bade another tell it. Whereunto he said, "So I thought: for," said he, "himself could not have put on so strong an imagination; but by telling the other the card (who believed that the juggler was some strange man, and could do strange things) that other man caught a strong imagination." I hearkened unto him, thinking for a vanity he spoke prettily. Then he asked me another question: saith he, "Do you remember, whether he bade the man think the card first, and afterwards told the other man in his ear, what he should think; or else that he did whisper first in the man's ear that should tell the card, telling that such a man should think such a card, and after bade the man think a card?" I told him, as was true, that he did first whisper the man in the ear, that such a man should think such a card. Upon this the learned man did much exult and please himself, saying; "Lo, you may see that my opinion is right: for if the man had thought first, his thought had been fixed; but the other imagining first, bound his thought." Which though it did somewhat sink with me, yet I made it lighter than I thought, and said, "I thought it was confederacy between the juggler and the two servants:" though indeed I had no reason so to think;

for they were both my father's servants, and he had never played in the house before.[1] The juggler also did cause a garter to be held up, and took upon him to know that such an one should point in such a place of the garter; as it should be near so many inches to the longer end, and so many to the shorter; and still he did it, by first telling the imaginer, and after bidding the actor think.

Having told this relation, not for the weight thereof, but because it doth handsomely open the nature of the question, I return to that I said; that experiments of imagination must be practised by others, and not by a man's self. For there be three means to fortify belief: the first is experience; the second is reason; and the third is authority: and that of these which is far the most potent, is authority; for belief upon reason or experience will stagger.

947. For authority, it is of two kinds; belief in an art, and belief in a man. And for things of belief in an art, a man may exercise them by himself; but for belief in a man, it must be by another. Therefore if a man believe in astrology, and find a figure prosperous; or believe in natural magic, and that a ring with such a stone, or such a piece of a living creature, carried,

[1] The psychology, if it may be so called, of juggling is an exceedingly curious matter. The common explanation of tricks of the kind of that described in the text, — namely, that the juggler forces a particular card on the person who is to choose, and that the latter remains unconscious of the compulsion put upon him, is, I suppose, correct. Bacon speaks only of thinking of a card, not of drawing one from the pack; but as the juggler had with him a pair (or pack) of cards, it may be presumed that the thought was manifested in an overt act. So, too, in the garter trick.

will do good; it may help his imagination; but the belief in a man is far the more active. But howsoever, all authority must be out of a man's self, turned (as was said) either upon an art, or upon a man; and where authority is from one man to another, there the second must be ignorant, and not learned, or full of thoughts; and such are (for the most part) all witches and superstitious persons; whose beliefs, tied to their teachers and traditions, are no whit controlled either by reason or experience; and upon the same reason, in magic, they use (for the most part) boys and young people; whose spirits easiliest take belief and imagination.

Now to fortify imagination, there be three ways: the authority whence the belief is derived; means to quicken and corroborate the imagination; and means to repeat it and refresh it.

948. For the authority, we have already spoken. As for the second, namely the means to quicken and corroborate the imagination; we see what hath been used in magic (if there be in those practices any thing that is purely natural); as vestments; characters; words; seals; some parts of plants, or living creatures; stones; choice of the hour; gestures and motions; also incenses and odours; choice of society, which increaseth imagination; diets and preparations for some time before. And for words, there have been ever used either barbarous words, of no sense, lest they should disturb the imagination; or words of similitude, that may second and feed the imagination: and this was ever as well in heathen charms as in charms of

latter times. There are used also Scripture words; for that the belief that religious texts and words have power, may strengthen the imagination. And for the same reason, Hebrew words (which amongst us is counted the holy tongue, and the words more mystical) are often used.

949. For the refreshing of the imagination (which was the third means of exalting it), we see the practices of magic; as in images of wax, and the like, that should melt by little and little; or some other things buried in muck, that should putrefy by little and little; or the like: for so oft as the imaginant doth think of those things, so oft doth he represent to his imagination the effect of that he desireth.

950. If there be any power in imagination, it is less credible that it should be so incorporeal and immateriate a virtue, as to work at great distances, or through all mediums, or upon all bodies; but that the distance must be competent, the medium not adverse, and the body apt and proportionate. Therefore if there be any operation upon bodies in absence by nature, it is like to be conveyed from man to man, as fame is; as if a witch by imagination should hurt any afar off, it cannot be naturally, but by working upon the spirit of some that cometh to the witch; and from that party upon the imagination of another; and so upon another; till it come to one that hath resort to the party intended; and so by him to the party intended himself. And although they speak, that it sufficeth to take a point, or a piece of the garment, or the name of the party, or the like; yet there is less credit to be given to those things, except it be by working of evil spirits.

The experiments which may certainly demonstrate the power of imagination upon other bodies, are few or none: for the experiments of witchcraft are no clear proofs; for that they may be by a tacit operation of malign spirits. We shall therefore be forced in this inquiry to resort to new experiments; wherein we can give only directions of trials, and not any positive experiments. And if any man think that we ought to have stayed till we had made experiment of some of them ourselves, (as we do commonly in other titles,) the truth is, that these effects of imagination upon other bodies have so little credit with us, as we shall try them at leisure: but in the mean time we will lead others the way.

951. When you work by the imagination of another, it is necessary that he by whom you work have a precedent opinion of you that you can do strange things, or that you are a man of art, as they call it; for else the simple affirmation to another that this or that shall be, can work but a weak impression in his imagination.

952. It were good, because you cannot discern fully of the strength of imagination in one man more than another, that you did use the imagination of more than one; that so you may light upon a strong one. As if a physician should tell three or four of his patients' servants, that their master shall surely recover.

953. The imagination of one that you shall use (such is the variety of men's minds) cannot be always alike constant and strong; and if the success follow not speedily, it will faint and leese strength. To

remedy this, you must pretend to him whose imagination you use, several degrees of means by which to operate; as to prescribe him that every three days, if he find not the success apparent, he do use another root, or part of a beast, or ring, &c., as being of more force; and if that fail, another; and if that, another; till seven times. Also you must prescribe a good large time for the effect you promise; as if you should tell a servant of a sick man that his master shall recover, but it will be fourteen days ere he findeth it apparently, &c. All this to entertain the imagination, that it waver less.

954. It is certain that potions, or things taken into the body; incenses and perfumes taken at the nostrils; and ointments of some parts; do (naturally) work upon the imagination of him that taketh them. And therefore it must needs greatly cooperate with the imagination of him whom you use, if you prescribe him, before he do use the receipt for the work which he desireth, that he do take such a pill, or a spoonful of liquor; or burn such an incense; or anoint his temples, or the soles of his feet, with such an ointment or oil: and you must choose, for the composition of such pill, perfume, or ointment, such ingredients as do make the spirits a little more gross or muddy; whereby the imagination will fix the better.

955. The body passive and to be wrought upon, (I mean not of the imaginant,) is better wrought upon (as hath been partly touched) at some times than at others: as if you should prescribe a servant about a sick person (whom you have possessed that his master shall recover) when his master is fast asleep, to use such a root, or such a root. For imagination is like to

work better upon sleeping men than men awake; as we shall shew when we handle dreams.

956. We find in the art of memory, that images visible work better than other conceits: as if you would remember the word *philosophy*, you shall more surely do it by imagining that such a man (for men are best places) is reading upon Aristotle's Physics; than if you should imagine him to say, *I'll go study philosophy*. And therefore this observation would be translated to the subject we now speak of: for the more lustrous the imagination is, it filleth and fixeth the better. And therefore I conceive that you shall, in that experiment (whereof we spake before) of binding of thoughts, less fail, if you tell one that such an one shall name one of twenty men, than if it were one of twenty cards. The experiment of binding of thoughts would be diversified and tried to the full: and you are to note whether it hit for the most part, though not always.

957. It is good to consider upon what things imagination hath most force: and the rule (as I conceive) is, that it hath most force upon things that have the lightest and easiest motions. And therefore above all, upon the spirits of men; and in them, upon such affections as move lightest; as upon procuring of love; binding of lust, which is ever with imagination; upon men in fear; or men in irresolution; and the like. Whatsoever is of this kind would be thoroughly inquired. Trials likewise would be made upon plants, and that diligently: as if you should tell a man, that such a tree would die this year; and will him at these and these times to go unto it, to see how it thriveth. As for inanimate things, it is true that the motions of

shuffling of cards, or casting of dice, are very light motions: and there is a folly very usual, that gamesters imagine, that some that stand by them bring them ill luck. There would be trial also made of holding a ring by a thread in a glass, and telling him that holdeth it, before, that it shall strike so many times against the side of the glass, and no more; or of holding a key between two men's fingers, without a charm; and to tell those that hold it that at such a name it shall go off their fingers; for these two are extreme light motions. And howsoever I have no opinion of these things, yet so much I conceive to be true; that strong imagination hath more force upon things living, or that have been living, than things merely inanimate: and more force likewise upon light and subtile motions, than upon motions vehement or ponderous.

958. It is an usual observation, that if the body of one murthered be brought before the murtherer, the wounds will bleed afresh. Some do affirm, that the dead body, upon the presence of the murtherer, hath opened the eyes; and that there have been such like motions, as well where the party murthered hath been strangled or drowned, as where they have been killed by wounds. It may be that this participateth of a miracle, by God's just judgment, who usually bringeth murthers to light: but if it be natural, it must be referred to imagination.

959. The tying of the point upon the day of marriage, to make men impotent towards their wives, which (as we have formerly touched) is so frequent in Zant and Gascony, if it be natural, must be referred to the imagination of him that tieth the point. I conceive it to have the less affinity with witchcraft, be-

cause not peculiar persons only, (such as witches are,) but any body may do it.

Experiments in consort touching the secret virtue of sympathy and antipathy.

960. There be many things that work upon the spirits of man by secret sympathy and antipathy: the virtues of precious stones, worn, have been anciently and generally received, and curiously assigned to work several effects. So much is true; that stones have in them fine spirits, as appeareth by their splendour; and therefore they may work by consent upon the spirits of men, to comfort and exhilarate them. Those that are the best for that effect, are the diamond, the emerald, the jacinth oriental, and the gold stone, which is the yellow topaz. As for their particular proprieties, there is no credit to be given to them. But it is manifest that light, above all things, excelleth in comforting the spirits of men: and it is very probable that light varied doth the same effect, with more novelty. And this is one of the causes why precious stones comfort. And therefore it were good to have tincted lanthorns, or tincted screens, of glass coloured into green, blue, carnation, crimson, purple, &c., and to use them with candles in the night. So likewise to have round glasses, not only of glass coloured through, but with colours laid between crystals, with handles to hold in one's hand. Prisms are also comfortable things. They have of Paris-work, looking-glasses bordered with broad borders of small crystal, and great counterfeit precious stones, of all colours, that are most glorious and pleasant to behold; especially in the night. The pictures of Indian feathers are likewise comfort-

able and pleasant to behold. So also fair and clear pools do greatly comfort the eyes and spirits; especially when the sun is not glaring, but overcast; or when the moon shineth.

961. There be divers sorts of bracelets fit to comfort the spirits; and they be of three intentions; refrigerant, corroborant, and aperient. For refrigerant, I wish them to be of pearl, or of coral, as is used; and it hath been noted that coral, if the party that weareth it be ill disposed, will wax pale; which I believe to be true, because otherwise distemper of heat will make coral lose colour. I commend also beads, or little plates of lapis lazuli; and beads of nitre, either alone or with some cordial mixture.

962. For corroboration and confortation, take such bodies as are of astringent quality, without manifest cold. I commend bead-amber; which is full of astriction, but yet is unctuous, and not cold; and is conceived to impinguate those that wear such beads; I commend also beads of hartshorn and ivory, which are of the like nature; also orange beads; also beads of lignum aloës, macerated first in rose-water, and dried.

963. For opening, I commend beads, or pieces of the roots of carduus benedictus: also of the roots of piony the male; and of orrice; and of calamus aromaticus; and of rue.

964. The cramp (no doubt) cometh of contraction of sinews; which is manifest, in that it cometh either by cold or dryness; as after consumptions, and long agues; for cold and dryness do (both of them) contract and corrugate. We see also that chafing a little above the place in pain, easeth the cramp; which is

wrought by the dilatation of the contracted sinews by heat. There are in use for the prevention of the cramp, two things; the one rings of sea-horse teeth worn upon the fingers; the other bands of green periwinkle (the herb) tied about the calf of the leg, or the thigh, &c., where the cramp useth to come. I do find this the more strange, because neither of these have any relaxing virtue, but rather the contrary. I judge therefore that their working is rather upon the spirits within the nerves, to make them strive less, than upon the bodily substance of the nerves.

965. I would have trial made of two other kinds of bracelets, for comforting the heart and spirits: the one of the trochisch of vipers, made into little pieces of beads; for since they do great good inwards (especially for pestilent agues), it is like they will be effectual outwards, where they may be applied in greater quantity. There would be trochisch likewise made of snakes; whose flesh dried is thought to have a very opening and cordial virtue. The other is, of beads made of the scarlet powder which they call kermes; which is the principal ingredient in their cordial confection alkermes: the beads would be made up with ambergrise, and some pomander.

966. It hath been long received, and confirmed by divers trials, that the root of the male-piony dried, tied to the neck, doth help the falling sickness; and likewise the incubus, which we call the mare.[1] The cause of both these diseases, and especially of the epilepsy from the stomach, is the grossness of the vapours

[1] Cardan (De Subtil. xviii. p. 641.) affirms that peony thus applied is good against gout, but he does not mention the falling sickness. But compare the same writer, *De Rer. Variet.* p. 172.

which rise and enter into the cells of the brain: and therefore the working is by extreme and subtile attenuation; which that simple hath. I judge the like to be in castoreum, musk, rue-seed, agnus castus seed, &c.

967. There is a stone which they call the blood-stone, which worn is thought to be good for them that bleed at the nose: which (no doubt) is by astriction and cooling of the spirits.[1] *Quære*, if the stone taken out of the toad's head be not of the like virtue; for the toad loveth shade and coolness.

968. Light may be taken from the experiment of the horse-tooth ring, and the garland of periwinkle, how that those things which assuage the strife of the spirits, do help diseases, contrary to the intention desired: for in the curing of the cramp, the intention is to relax the sinews; but the contraction of the spirits, that they strive less, is the best help: so to procure easy travails of women, the intention is to bring down the child; but the best help is, to stay the coming down too fast: whereunto they say the toad-stone likewise helpeth. So in pestilent fevers, the intention is to expel the infection by sweat and evaporation: but the best means to do it is by nitre, disascordium, and other cool things, which do for a time arrest the expulsion, till nature can do it more quietly. For as one saith prettily: *In the quenching of the flame of a pestilent ague, nature is like people that come to quench the fire of a house; which are so busy, as one of them letteth another.* Surely it is an excellent axiom, and of manifold use, that whatsoever appeaseth the contention of spirits, furthereth their action.

[1] See Joyful News, &c., p. 18.

969. The writers of natural magic commend the wearing of the spoil of a snake, for preserving of health. I doubt it is but a conceit; for that the snake is thought to renew her youth by casting her spoil. They might as well take the beak of an eagle, or a piece of a hart's horn, because those renew.

970. It hath been anciently received, (for Pericles the Athenian used it,) and it is yet in use, to wear little bladders of quicksilver, or tablets of arsenic, as preservatives against the plague: not as they conceive, for any comfort they yield to the spirits, but for that being poisons themselves, they draw the venom to them from the spirits.[1]

971. Vide the experiments 95, 96, and 97, touching the several sympathies and antipathies for medicinal use.

972. It is said that the guts or skin of a wolf, being applied to the belly, do cure the colic.[2] It is true, that the wolf is a beast of great edacity and digestion; and so, it may be, the parts of him comfort the bowels.

[1] I do not know where this is related of Pericles. Mercurialis, in his *De Venenis et Morbis venenosis*, ii. 9. (Venice, 1583), speaks of it as a recent invention, so that he at least did not believe that Pericles had employed it. Mercurialis was eminently learned in medical literature, so that his silence on this point deserves notice. Straussius affirms that Carpi, who died in 1550, is the first writer who mentions the practice, but that it appears to have been common in Turkey at an earlier time. See Straussius, *Epist. ad Comit. Digbœum* (Kenelm Digby), in the *Theatrum Sympatheticum*, p. 136., and for a full account of all arsenical and other amulets Isbrand de Diemerbroeck, *De Peste*, ii. 11., who refers to a great number of writers. I may add to those he has mentioned, Cæsalpinus, *De Rebus Metallicis*, i. 30., and Septalius, *De Peste*. [Bacon was perhaps thinking of the charm which Pericles wore about his neck when he was ill of the plague; which is mentioned by Plutarch, on the authority of Theophrastus. — *J. S.*]

[2] Cardan, De Subtil. xviii. p. 639. Almost all the statements in the succeeding paragraphs, to 980. inclusive, are taken from Cardan. See the *De Subtil.* p. 639. to p. 641.

973. We see scare-crows are set up to keep birds from corn and fruit. It is reported by some that the head of a wolf, whole, dried, and hanged up in a dove-house, will scare away vermin; such as are weasels, polecats, and the like. It may be the head of a dog will do as much; for those vermin with us, know dogs better than wolves.

974. The brains of some creatures (when their heads are roasted) taken in wine, are said to strengthen the memory; as the brains of hares, brains of hens, brains of deers, &c. And it seemeth to be incident to the brains of those creatures that are fearful.[1]

975. The ointment that witches use is reported to be made of the fat of children digged out of their graves; of the juices of smallage, wolf-bane, and cinque-foil, mingled with the meal of fine wheat. But I suppose that the soporiferous medicines are likest to do it; which are henbane, hemlock, mandrake, moon-shade, tobacco, opium, saffron, poplar-leaves, &c.

976. It is reported by some that the affections of beasts, when they are in strength, do add some virtue unto inanimate things; as that the skin of a sheep devoured by a wolf, moveth itching; that a stone bitten by a dog in anger, being thrown at him, drunk in powder, provoketh choler.

977. It hath been observed that the diet of women with child doth work much upon the infant; as if the mother eat quinces much, and coriander-seed, (the nature of both which is to repress and stay vapours that

[1] It seems difficult to understand why the brain of one animal should have more effect than that of another, but as phosphorus appears to exist in a peculiar state in the brain, it is quite possible that in cases in which a failure of memory arises from deficient nutrition of the organ (assuming that there are such cases), the diet mentioned in the text might be useful.

ascend to the brain,) it will make the child ingenious; and on the contrary side, if the mother eat (much) onions or beans, or such vaporous food; or drink wine or strong drink immoderately; or fast much; or be given to much musing; (all which send or draw vapours to the head;) it endangereth the child to become lunatic, or of imperfect memory: and I make the same judgment of tobacco often taken by the mother.

978. The writers of natural magic report that the heart of an ape, worn near the heart, comforteth the heart, and increaseth audacity. It is true that the ape is a merry and bold beast. And that the same heart likewise of an ape, applied to the neck or head, helpeth the wit; and is good for the falling sickness: the ape also is a witty beast, and hath a dry brain; which may be some cause of attenuation of vapours in the head. Yet it is said to move dreams also. It may be the heart of a man would do more, but that it is more against men's minds to use it; except it be in such as wear the reliques of saints.

979. The flesh of a hedge-hog, dressed and eaten, is said to be a great drier: it is true that the juice of a hedge-hog must needs be harsh and dry, because it putteth forth so many prickles: for plants also that are full of prickles are generally dry; as briars, thorns, berberries; and therefore the ashes of a hedge-hog are said to be a great desiccative of fistulas.

980. Mummy hath great force in stanching of blood; which, as it may be ascribed to the mixture of balms that are glutinous; so it may also partake of a secret propriety; in that the blood draweth man's flesh. And it is approved that the moss which groweth upon the skull of a dead man unburied, will stanch blood po-

tently: and so do the dregs, or powder of blood, severed from the water, and dried.

981. It hath been practised, to make white swallows, by anointing of the eggs with oil.[1] Which effect may be produced by the stopping of the pores of the shell, and making the juice, that putteth forth the feathers afterwards, more penurious. And it may be, the anointing of the eggs will be as effectual as the anointing of the body; of which vide the experiment 93.

982. It is reported that the white of an egg, or blood, mingled with salt-water, doth gather the saltness, and maketh the water sweeter. This may be by adhesion; as in the sixth experiment of clarification: it may be also, that blood, and the white of an egg, (which is the matter of a living creature,) have some sympathy with salt: for all life hath a sympathy with salt. We see that salt laid to a cut finger healeth it; so as it seemeth salt draweth blood, as well as blood draweth salt.

983. It hath been anciently received that the sea-hare hath an antipathy with the lungs, (if it cometh near the body,) and erodeth them. Whereof the cause is conceived to be, a quality it hath of heating the breath and spirits; as cantharides have upon the watery parts of the body, as urine and hydropical water. And it is a good rule, that whatsoever hath an operation upon certain kinds of matters, that, in man's body, worketh most upon those parts wherein that kind of matter aboundeth.

984. Generally, that which is dead, or corrupted, or excerned, hath antipathy with the same thing when it

[1] Cardan, De Rerum Varietate, xvi. 90. p. 811.

is alive, and when it is sound;[1] and with those parts which do excern: as a carcase of man is most infectious and odious to man; a carrion of an horse to an horse, &c.; purulent matter of wounds, and ulcers, carbuncles, pocks, scabs, leprosy, to sound flesh; and the excrement of every species to that creature that excerneth them. But the excrements are less pernicious than the corruptions.

985. It is a common experience, that dogs know the dog-killer; when, as in times of infection, some petty fellow is sent out to kill the dogs; and that, though they have never seen him before, yet they will all come forth, and bark, and fly at him.

986. The relations touching the force of imagination and the secret instincts of nature, are so uncertain, as they require a great deal of examination ere we conclude upon them. I would have it first throughly inquired, whether there be any secret passages of sympathy between persons of near blood; as parents, children, brothers, sisters, nurse-children, husbands, wives, &c. There be many reports in history, that upon the death of persons of such nearness, men have had an inward feeling of it. I myself remember, that being in Paris, and my father dying in London, two or three days before my father's death I had a dream, which I told to divers English gentlemen, that my father's house in the country was plastered all over with black mortar. There is an opinion abroad, (whether idle or no I cannot say,) that loving and kind husbands have a sense of their wives breeding child, by some accident in their own body.

[1] "Horret enim omne simile maxime simile cum corruptum est." — *Cardan, De Subtil.* p. 641.

987. Next to those that are near in blood, there may be the like passage and instincts of nature between great friends and enemies: and sometimes the revealing is unto another person, and not to the party himself. I remember Philippus Commineus (a grave writer) reporteth, that the Archbishop of Vienna (a reverend prelate) said one day after mass to King Lewis the eleventh of France: *Sir, your mortal enemy is dead;* what time Charles Duke of Burgundy was slain at the battle of Granson against the Switzers.[1] Some trial also would be made, whether pact or agreement do any thing; as if two friends should agree, that such a day in every week, they, being in far distant places, should pray one for another, or should put on a ring or tablet one for another's sake; whether if one of them should break their vow and promise, the other should have any feeling of it in absence.

988. If there be any force in imaginations and affections of singular persons, it is probable the force is much more in the joint imaginations and affections of multitudes: as if a victory should be won or lost in

[1] Charles the Bold was not killed at Granson, but at Nancy; nor is the story told by Philippe de Comines. We have no authority for it but that of the anonymous author of an account of Angelo Caltho, Archbishop of Vienne, to whom Comines inscribed his memoirs. This account is prefixed to several editions of them, and first, I believe, to that which Sauvage published in 1605. In truth, Comines' silence is, as Bayle remarks, almost conclusive against the story, and it is remarkable that Bacon should have ascribed it to him, as Sauvage, whose edition Bacon probably used, notes in the margin that it is odd that Comines should have omitted so singular an incident. Caltho is called Cato in Madlle. Dupont's edition of Comines. He was a native of Tarento, and was a long time in the service of the Duke of Burgundy, whom he deserted after the defeat at Granson. A similar story is told with respect to Richard Cœur de Lion, — that his death was announced at Rome on the day it happened, by a bishop whom he had deprived of his see. "Telum Limogiæ," said the bishop, interrupting himself while he was performing mass, "occidit Leonem Angliæ."

remote parts, whether is there not some sense thereof in the people whom it concerneth; because of the great joy or grief that many men are possessed with at once? Pius Quintus, at the very time when that memorable victory was won by the Christians against the Turks, at the naval battle of Lepanto, being then hearing of causes in the consistory, brake off suddenly, and said to those about him, *It is now more time we should give thanks to God for the great victory he has granted us against the Turks:* it is true that victory had a sympathy with his spirit; for it was merely his work to conclude that league.[1] It may be that revelation was divine: but what shall we say then to a number of examples amongst the Grecians and Romans? where the people being in theatres at plays, have had news of victories and overthrows, some few days before any messenger could come.

It is true that that may hold in these things, which is the general root of superstition; namely, that men observe when things hit, and not when they miss; and commit to memory the one, and forget and pass over the other. But touching divination, and the misgiving of minds, we shall speak more when we handle in general the nature of minds, and souls, and spirits.

989. We have given formerly some rules of imagi-

[1] This story rests upon better authority than most stories of the same kind. Catena tells it in his Life of Pius V., published in 1586, only fourteen years after the battle. The Pope was not engaged in hearing causes, but in transacting affairs of state with his minister Bussoti. See Catena, *Vita di Pio V.* p. 195. Cardinal de Perron mentions it as a thing which everybody at Rome knew to be true.

nation; and touching the fortifying of the same. We have set down also some few instances and directions, of the force of imagination upon beasts, birds, &c.; upon plants; and upon inanimate bodies: wherein you must still observe, that your trials be upon subtile and light motions, and not the contrary; for you will sooner by imagination bind a bird from singing than from eating or flying; and I leave it to every man to choose experiments which himself thinketh most commodious; giving now but a few examples of every of the three kinds.

990. Use some imaginant, (observing the rules formerly prescribed,) for binding of a bird from singing; and the like of a dog from barking. Try also the imagination of some, whom you shall accommodate with things to fortify it, in cock-fights, to make one cock more hardy and the other more cowardly. It would be tried also in flying of hawks; or in coursing of a deer, or hart, with grey-hounds; or in horse-races; and the like comparative motions; for you may sooner by imagination quicken or slack a motion, than raise or cease it; as it is easier to make a dog go slower, than to make him stand still that he may not run.

991. In plants also, you may try the force of imagination upon the lighter sort of motions: as upon the sudden fading, or lively coming up of herbs; or upon their bending one way or other; or upon their closing and opening, &c.

992. For inanimate things, you may try the force of imagination upon staying the working of beer when the barm is put in; or upon the coming of butter or cheese, after the churning,[1] or the rennet be put in.

[1] *cherning* in the original. — *J. S.*

993. It is an ancient tradition every where alleged, for example of secret proprieties and influxes, that the torpedo marina, if it be touched with a long stick, doth stupefy the hand of him that toucheth it. It is one degree of working at distance, to work by the continuance of a fit medium; as sound will be conveyed to the ear by striking upon a bow-string, if the horn of the bow be held to the ear.

994. The writers of natural magic do attribute much to the virtues that come from the parts of living creatures; so as they be taken from them, the creatures remaining still alive:[1] as if the creature still living did infuse some immateriate virtue and vigour into the part severed. So much may be true; that any part taken from a living creature newly slain, may be of greater force than if it were taken from the like creature dying of itself, because it is fuller of spirit.

995. Trial would be made of the like parts of individuals in plants and living creatures; as to cut off a stock of a tree, and to lay that which you cut off to putrefy, to see whether it will decay the rest of the stock: or if you should cut off part of the tail or leg of a dog or a cat, and lay it to putrefy, and so see whether it will fester, or keep from healing, the part which remaineth.

996. It is received, that it helpeth to continue love, if one wear a ring, or a bracelet, of the hair of the party beloved. But that may be by the exciting of the imagination: and perhaps a glove, or other like favour, may as well do it.

997. The sympathy of individuals, that have been entire, or have touched, is of all others the most in-

[1] Porta, Natural Magic, i. 14.

credible; yet according unto our faithful manner of examination of nature, we will make some little mention of it. The taking away of warts, by rubbing them with somewhat that afterwards is put to waste and consume, is a common experiment; and I do apprehend it the rather, because of mine own experience. I had, from my childhood, a wart upon one of my fingers: afterwards, when I was about sixteen years old, being then at Paris, there grew upon both my hands a number of warts (at the least an hundred) in a month's space. The English ambassador's lady, who was a woman far from superstition, told me one day, she would help me away with my warts: whereupon she got a piece of lard, with the skin on, and rubbed the warts all over with the fat side; and amongst the rest, that wart which I had had from my childhood: then she nailed the piece of lard, with the fat towards the sun, upon a post of her chamber window, which was to the south. The success was, that within five weeks' space all the warts went quite away: and that wart which I had so long endured, for company. But at the rest I did little marvel, because they came in a short time, and might go away in a short time again: but the going away of that which had stayed so long, doth yet stick with me. They say the like is done by rubbing of warts with a green elder stick, and then burying the stick to rot in muck. It would be tried with corns and wens, and such other excrescences. I would have it also tried with some parts of living creatures that are nearest the nature of excrescences; as the combs of cocks, the spurs of cocks, the horns of beasts, &c. And I would have it tried both ways; both by rubbing those parts with lard, or elder, as before;

and by cutting off some piece of those parts, and laying it to consume; to see whether it will work any effect towards the consumption of that part which was once joined with it.

998. It is constantly received and avouched, that the anointing of the weapon that maketh the wound, will heal the wound itself. In this experiment, upon the relation of men of credit, (though myself, as yet, am not fully inclined to believe it,) you shall note the points following. First, the ointment wherewith this is done is made of divers ingredients; whereof the strangest and hardest to come by, are the moss upon the skull of a dead man unburied, and the fats of a boar and a bear killed in the act of generation. These two last I could easily suspect to be prescribed as a starting-hole; that if the experiment proved not, it might be pretended that the beasts were not killed in the due time: for as for the moss, it is certain there is great quantity of it in Ireland, upon slain bodies, laid on heaps unburied. The other ingredients are, the blood-stone in powder, and some other things, which seem to have a virtue to stanch blood; as also the moss hath. And the description of the whole ointment is to be found in the chemical dispensatory of Crollius.[1] Secondly, the same kind of ointment applied to the hurt itself worketh not the effect; but only applied to the weapon. Thirdly, (which I like well,) they do not observe the confecting of the ointment under any certain constellation; which commonly is the excuse of magical medicines when they fail, that they were

[1] See his *Basilica Chymica*, p. 400. In the edition I have seen, that of 1643, nothing is said as to the time of killing the bear and the boar. On the subject of "unguenta armaria," see a collection of tracts in the *Theatrum Sympatheticum*.

not made under a fit figure of heaven. Fourthly, it may be applied to the weapon, though the party hurt be at great distance. Fifthly, it seemeth the imagination of the party to be cured is not needful to concur; for it may be done without the knowledge of the party wounded: and thus much hath been tried, that the ointment (for experiment's sake) hath been wiped off the weapon, without the knowledge of the party hurt, and presently the party hurt hath been in great rage of pain, till the weapon was re-anointed. Sixthly, it is affirmed that if you cannot get the weapon, yet if you put an instrument of iron or wood, resembling the weapon, into the wound, whereby it bleedeth, the anointing of that instrument will serve and work the effect. This I doubt should be a device to keep this strange form of cure in request and use; because many times you cannot come by the weapon itself. Seventhly, the wound must be at first washed clean with white wine, or the party's own water; and then bound up close in fine linen, and no more dressing renewed till it be whole. Eighthly, the sword itself must be wrapped up close, as far as the ointment goeth, that it taketh no wind. Ninthly, the ointment, if you wipe it off from the sword and keep it, will serve again; and rather increase in virtue than diminish. Tenthly, it will cure in far shorter time than ointments of wounds commonly do. Lastly, it will cure a beast, as well as a man; which I like best of all the rest, because it subjecteth the matter to an easy trial.

Experiment solitary touching secret proprieties.

999. I would have men know, that though I reprehend the easy passing over of the causes of things, by

ascribing them to secret and hidden virtues and proprieties; (for this hath arrested and laid asleep all true inquiry and indications;) yet I do not understand but that in the practical part of knowledge, much will be left to experience and probation, whereunto indication cannot so fully reach: and this not only in *specie*, but in *individuo*. So in physic, if you will cure the jaundice,[1] it is not enough to say that the medicine must not be cooling; for that will hinder the opening which the disease requireth: that it must not be hot; for that will exasperate choler: that it must go to the gall; for there is the obstruction which causeth the disease, &c. But you must receive from experience, that powder of Chamæpitys, or the like, drunk in beer, is good for the jaundice.[2] So again, a wise physician doth not continue still the same medicine to a patient; but he will vary, if the first medicine doth not apparently succeed: for of those remedies that are good for the jaundice, stone, agues, &c., that will do good in one body which will not do good in another; according to the correspondence the medicine hath to the individual body.

Experiment solitary touching the general sympathy of men's spirits.

1000. The delight which men have in popularity, fame, honour, submission and subjection of other men's minds, wills, or affections, (although these things may be desired for other ends,) seemeth to be a thing in itself, without contemplation of consequence, grateful and agreeable to the nature of man. This thing (surely) is not without some signification, as if all spirits and souls of men came forth out of one divine

[1] *jaundies* in the original. — *J. S.*

[2] See Pliny, xxiv. 20.

limbus; else why should men be so much affected with that which others think or say? The best temper of minds desireth good name and true honour: the lighter, popularity and applause: the more depraved, subjection and tyranny; as is seen in great conquerors and troublers of the world; and yet more in arch-heretics; for the introducing of new doctrines is likewise an affectation of tyranny over the understandings and beliefs of men.

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NOTE.

I have not been able to procure a copy of the first edition of the *Sylva Sylvarum*, which was published in 1627. Wherever therefore I speak of "the original," I must be understood to refer to the *second* edition, which appeared in 1628. The same remark will apply to the *New Atlantis*, in this volume. — *J. S.*

SCALA INTELLECTUS

PREFACE

TO THE

SCALA INTELLECTUS AND PRODROMI.

THE two following pieces (which complete the first part of the Philosophical Works) were first published by Gruter in 1653. They are not included in Dr. Rawley's *Opuscula* (1658), nor mentioned in his list of Bacon's later writings. As to the date of their composition, I can find no grounds even for a guess. Either of them might apparently have been written at any time after the plan of the *Instauratio* in its six parts had been once conceived. Gruter places them among what he calls *Impetus Philosophici;* which merely means that they came to him as loose sheets without any direction under what title to arrange them. There can be no doubt however that they were intended as prefaces to the fourth and fifth parts of the *Instauratio* respectively; nor is there any reason to suppose that they had been either abandoned or superseded. Being unable therefore to follow the order of composition, I follow the order of matter, and put them here where they were meant ultimately to stand.

With these prefaces the collection of works published or designed for publication as parts of the *In-*

stauratio Magna must close. Of the fourth part not even any fragment has come down to us, unless the *Inquisitio legitima de Motu, sive Filum Labyrinthi*, be taken for one. But though this was undoubtedly intended to be "veræ et legitimæ de rebus inquisitionis *exemplar*,"— and such it was the business of the fourth part to exhibit, — I rather think that it was designed originally for the *second* part (as the example in which the new method was to be set forth), and that the *Inquisitio de Formâ Calidi* was substituted for it. I have preferred therefore to place it among the works abandoned or superseded.

With regard to the fifth part however, I am not so confident that Mr. Ellis is right in refusing a place in it to the *De Fluxu et Refluxu*, the *Thema Cœli*, the *De Principiis atque Originibus*, and the *Cogitationes de Naturâ Rerum;* all which he classes as "occasional writings, not belonging to the circuit of the *Instauratio*." It is true that they were written long before the publication of the *Novum Organum*, and that they do not come within the circuit of Bacon's work on the Interpretation of Nature as originally projected. That work (to judge by the title, which has fortunately been preserved) was to be distributed into three books, the first to prepare the mind, the second to explain the method, the third to exhibit the results of the method applied. It must therefore have been designed to cover the ground occupied by the second and sixth parts of the *Instauratio*, and perhaps also that occupied by the third and fourth; but could not have been meant to contain anything answering to the first and fifth. My own impression however is, that one of Bacon's objects in enlarging the design was to make a place

in the great structure for occasional writings of this kind, which could not have properly come into any of those three books originally planned. The addition of the third and fourth parts indeed, — that is, the assigning of a separate part to the *Phænomena Universi*, and a separate part to the *Scala Intellectus*, — may be regarded as a development merely of the original idea; for the exposition of the new method could not be complete without at least one perfect example of an inquiry legitimately conducted through all the processes and ending in the discovery of the *form;* nor could such an example be exhibited without a specimen of the "historia naturalis et experimentalis quæ sit in ordine ad condendam philosophiam," in reference at least to that one subject. But the matter to be contained in the first and fifth was avowedly extraneous to the main design; and the addition of these is most easily accounted for by supposing that in prefixing the first, Bacon meant to make a place for the *Advancement of Learning* and for a variety of miscellaneous works not bearing on natural philosophy; and in interpolating the fifth, for sundry philosophical speculations which his studies had suggested to him, and which he regarded as guesses worth preserving; though, being no better than "anticipationes mentis," — conclusions derived through an imperfect logical machinery from imperfect knowledge, — they were to be looked upon as provisional only, and by no means as specimens of the *Philosophia Secunda.*

If there be any truth in this conjecture, the pieces which I have mentioned have a fair claim to a place among the *Prodromi*, and might follow the preface. In deference however to Mr. Ellis's judgment I have

placed them in a class by themselves. If any reader prefers to regard them as belonging to the *Instauratio*, he has only to pass to the next volume,* overlook the titlepage, and read on.

This collection of the fragments of the Great Instauration as Bacon left it could hardly however have been concluded more appropriately than with the two short pieces which follow; in which we see the vision which suggested the enterprise, the grounds of reason which seemed to justify it as sober and practicable, the hope which sustained and the spirit which regulated it, still as fresh as when he started; but the end as far off as ever, and all the laborious preparations for the future harvest breaking off abruptly in a reiteration of the exhortations, warnings, and promises, with which they were commenced.

Atque opere in medio defixa reliquit aratra!

J. S.

* In this edition these pieces, except *Thema Cœli.* are contained in this volume.

SCALA INTELLECTUS

SIVE

FILUM LABYRINTHI.

Difficilis sane foret reprehensio eorum quibus *nihil sciri* placuit, si decretum durum interpretatione molliore correxissent. Si quis enim asserat, hoc ipsum scire, recte acceptum, esse per causas scire; causarum autem cognitionem gliscere, et serie et veluti catena perpetua ad notissima naturæ scandere, adeo ut particularium rerum cognitio, absque exacta universæ naturæ comprehensione, proprie non absolvatur; non facile invenias quod sano cum judicio contradici possit. Nam et veram alicujus rei scientiam haberi posse antequam mens in causarum explicatione plane consistat, minus consentaneum; et perfectam universi cognitionem humanæ naturæ attribuere atque asserere, temerarium fortasse quiddam atque impotentis cujusdam animi censeri possit. Verum illi contra, nulla hujusmodi usi interpretatione aut moderatione, sensuum oracula prorsus profanare non veriti sunt; quod cum summa rerum desperatione conjunctum est. Quod si verum omnino dicendum sit; etiamsi ab hac calumnia abstinuissent, tamen hæc ipsa lis

intempestive et contentiose mota videatur; cum citra istam quam intelligere videntur ipsissimam veritatem tantus humanæ industriæ pateat campus, ut sit res præpostera et quasi mentis commotæ et perturbatæ, de extremis obtinendis solicitum tantas in medio sitas utilitates prætermittere. Nam utcunque per *veri* et *probabilis* distinctionem, scientiæ certitudinem destruere, usum retinere, videri volunt; atque, quoad activam partem, delectum rerum illæsum relinquere; tamen, sublata ex animis hominum veritatis exquirendæ spe, proculdubio nervos inquisitioni humanæ inciderunt, et promiscua quærendi licentia, inveniendi negotium in exercitationem quandam ingenii et disputationis verterunt. Veruntamen negare plane non possumus, quin si qua nobis cum antiquis intercedat societas, ea cum hoc genere philosophiæ maxime conjuncta sit; cum multa ab illis de sensuum variationibus et judicii humani infirmitate et de cohibendo et sustinendo assensu prudenter dicta et animadversa probemus; quibus etiam innumera alia, quæ eodem pertinent, adjungere possemus; adeo ut inter nos et illos hoc tantum intersit, quod illi nil vere sciri posse prorsus, nos nil vere sciri posse ea qua adhuc gens humana ingressa est via, statuamus. Neque vero hujus societatis nos pudet. Si enim in hunc cœtum recipiantur non solum ii qui sententia et placito hoc tenent et opinantur, sed et illi qui idem aut forma ipsa interrogandi et objiciendi præ se ferunt, aut conquerendo de rerum obscuritate et indignando fatentur et quasi clamant, aut secreto animo agitant et raris et occultis vocibus veluti insusurrant, invenias in hoc numero viros ex antiquis longe maximos, et

contemplationum principes, in quorum consortium includi neminem pœniteat. Pronuntiandi enim confidentiam fortasse unus aut alter ex antiquis usurpavit; neque tamen invaluit ea ipsa, nisi haud ita pridem barbaris seculis; nunc autem factione quadam, atque consuetudine et incuria, retinetur. Sed tamen rursus in hac de qua diximus societate facile quis perspexerit, nos erga illos viros initiis opinionum conjunctos, exitu in immensum divisos esse. Etsi enim primo non multum dissentire videamur, quod illi incompetentiam humani intellectus simpliciter, nos sub modo asseramus; nihilominus huc res redit, ut illi, nullum huic malo remedium invenientes aut sperantes, negotium deserant; et sensus certitudinem invadendo, scientiam ab imis fundamentis evertant: nos, novam viam afferentes, tum sensus tum mentis errores regere et restituere conemur. Itaque illi, jactam arbitrati aleam, ad ingenii quandam peregrinationem liberam et amœnam se vertunt: nobis ex opinione nostra difficilis et remota obvenit provincia, quæ ut generi humano felix et fausta sit perpetuo precamur. Itaque initia viarum secundo libro descripsimus; easdem ipsi continuo ingressi,[1] tertio Phænomena Universi et Historiam tractavimus; in quo certe sylvas naturæ, et variatione infinita experimentorum veluti foliis opacas et obscuras, et observationum subtilitate veluti virgultis et vepribus implicatas, penetravimus et præterivimus. Atque nunc ad magis aperta fortasse sed tamen ad magis ardua pervenimus, ex sylvis scilicet ad radices montium. Nam ab historia ad universalia certo at-

[1] The original has a full stop after *ingressi*. I have followed the example of M. Bouillet in substituting a comma. — *J. S.*

que constanti tramite (licet via nova et intentata) ducemus. Atque certe non male in vias contemplationum conveniret illud celebre et decantatum apud antiquos bivium vitæ activæ; ex quo via altera, primo ingressu plana et facilis, ducebat ad prærupta et impervia; altera, a principio ardua et suspensa, in plana desinebat.[1] Nam eodem prorsus modo, qui jam inde a prima inquisitione immobilia quædam in scientiis principia prensabit, quibus acquiescens cætera veluti per otium expediat; illum, si modo perrexerit nec nimium sibi placens aut displicens ab inquisitione destiterit, prioris viæ fortuna manet. Qui autem judicium cohibere, et gradatim adscendere, et rerum veluti montium juga, unum primo, deinde alterum ac rursus alterum, superare, cum patientia vera et indefessa sustinuerit; ille ad summitates et vertices naturæ mature perveniet, ubi et statio serena et pulcherrimus rerum prospectus et descensus molli clivo ducens ad omnes practicas. Itaque consilium nostrum est, veræ et legitimæ de rebus inquisitionis, ut in secundo libro præcepta, ita hic exemplaria proponere et describere pro varietate subjectorum; idque ea forma, quam cum veritate summum consensum habere putamus, atque ut probatam et electam tradimus. Neque tamen, more apud homines recepto, omnibus hujus formulæ partibus necessitatem quandam attribuimus, tanquam unicæ essent et inviolabiles. Neque enim hominum industriam et felicitatem veluti ad columnam alligandas existimamus. Atque nihil officit, quo minus ii qui otio magis abundant, aut a difficultatibus quas primo experien-

[1] Hesiod. Oper. 287.

tem sequi necesse est liberi jam erunt, rem monstratam in potius perducant. Quin contra, artem veram adolescere statuimus.[1]

[1] So in the original. Possibly the manuscript was imperfect at the end, and the sentence completed by conjecture: for this can hardly be what Bacon wrote. The aphorism is repeated in many places, and always in the form *artem inveniendi cum inventis adolescere.* See the end of the first book of the *Novum Organum.* — *J. S.*

PRODROMI

SIVE

ANTICIPATIONES PHILOSOPHIÆ SECUNDÆ.

PRÆFATIO.

EXISTIMAMUS eum et amantis civis et viri prudentis personam bene simul sustinuisse, qui interrogatus an optimas leges suis civibus dedisset, optimas certe, dixit, ex iis quas illi accepturi fuissent.[1] Atque certe quibus non tantum bene cogitasse satis est (quod non multo secus est ac bene somniasse) nisi obtineant quoque et rem ad effectum perducant, iis non optima utique, sed ex iis quæ probari verisimile est potissima, quandoque eligenda sunt. Nobis vero, licet Humanam Rempublicam, patriam communem, summo prosequamur amore, tamen legislatoria illa ratione et delectu uti liberum non est. Neque enim leges intellectui aut rebus damus ad arbitrium nostrum, sed tanquam scribæ fideles ab ipsius naturæ voce latas et prolatas excipimus et describimus. Itaque sive illæ placeant, sive per opinionum suffragia antiquentur, fides nostra omnino exsolvenda est. Neque tamen spem abjecimus, quin sint atque exoriantur apud posteros nonnulli, qui optima quæque capere et conco-

[1] Diog. Laert. in Sol.

quere possint, et quibus ea perficere et colere curæ erit. Itaque ad illa ipsa tendere, atque fontes rerum et utilitatum aperire, et viarum indicia undique conquirere (invocata Numinis ope), nunquam dum in vivis erimus desistemus. Iidem nos, de eo quod ad omnes pertinere et in commune prodesse possit soliciti, dum ad majora contendimus, minora non aspernamur (cum illa remota, hæc parata esse soleant), nec potiora (ut arbitramur) afferentes, idcirco veteribus ac receptis, quominus illa apud plurimos valeant, intercedimus; quinetiam ea ipsa et aucta et emendata et in honore esse cupimus. Neque enim homines aut omnes aut omnino aut statim a receptis et creditis abducere conamur. Sed quemadmodum sagitta aut missile fertur certe in processu, sed tamen interim conversiones suas perpetuo expedit, progrediendo et nihilominus rotando; ita et nos, dum ad ulteriora rapimur, in receptis et cognitis volvimur et circumferimur. Quamobrem nos quoque rationis ipsius communis et demonstrationum vulgarium (abdicato licet imperio earum) honesta opera utimur; atque ea quæ nobis secundum eas inventa et judicata sunt, quæque plurimum et veritatis et utilitatis habere possunt, pari cum cæteris jure proponemus. Sed tamen neque per hoc iis quæ de rationis nativæ et demonstrationum veterum incompetentia dicta sunt derogatum quidquam intelligimus. Quin hæc potius adjunximus ad tempus, et in gratiam eorum qui justa excusatione aut virium aut occupationum retardati contemplationes suas intra veteres scientiarum plagas et provincias, aut saltem earum confinia contermina, sistere volent. Eadem iis qui veram naturæ interpretationem secundum indicia nostra accedent, eamque molientur,

loco diverticulorum aut tabernaculorum in via præbitorum ad solatium et levamentum esse queant; atque interim humanas fortunas aliqua ex parte juvare, et mentes cogitationibus quæ paulo arctiorem cognationem habeant cum natura perfundere. Id vero ex facultate aliqua nostra, aut ejus fiducia, minime ominamur. Verum nobis dubium non est, si quis mediocris licet ingenii, sed tamen animi maturus, idola mentis suæ deponere atque inquisitionem de integro sibi decernere atque inter vera historiæ naturalis atque ejus calculos attente et diligenter et libere versari velit et possit; quin ille ipse, quisquis sit, longe altius in naturam penetraturus sit ex sese, et propriis et genuinis mentis viribus, denique ex meris Anticipationibus suis, quam per omnigenam authorum lectionem, aut meditationem abstractam infinitam, aut disputationes assiduas et repetitas; etsi machinas non admoverit, nec interpretandi formam secutus fuerit. Quare et simile quippiam nobis usu venire posse non diffidimus; præsertim cum accedat interpretandi experimentum et exercitatio, quam ipsum habitum mentis corrigere et mutare probabile est. Neque tamen hæc in eam partem accipi volumus, ac si fidem quam antiquorum placitis denegavimus nostris adhiberi postulemus. Quin contra testamur et profitemur, nos ipsos istis quæ jam proponemus, qualiacunque ea sint, teneri minime velle, ut omnia Philosophiæ nostræ Secundæ et Inductivæ tamquam integra serventur. Cogitata autem ipsa spargere, non methodo revincire, visum est. Hæc enim forma pubescentibus tamquam a stirpe de integro scientiis debetur; atque ejus est, qui non artem constituere ex connexis, sed inquisitionem liberam instituere in singulis, in præsentia tantum velit.

PHILOSOPHICAL WORKS.

PART II.

WORKS ON SUBJECTS CONNECTED WITH THE INSTAURATIO MAGNA, BUT NOT MEANT TO BE INCLUDED IN IT;

ARRANGED

ACCORDING TO THE ORDER IN WHICH THEY WERE WRITTEN.

Ista enim nos tanquam in limine Historiæ Naturalis stantes prospicimus, quæ quanto magis quis se immerserit in Historiam Naturalem tanto fortasse probabit magis. Attamen testamur iterum nos hic teneri nolle. In his enim, ut in aliis, certi viæ nostræ sumus, certi sedis nostræ non sumus. — *Thema Cœli*, 1612.

PREFACE.

ALL the works except one which belong to this part, and several of the most interesting among those which follow in the next, were published by Isaac Gruter in 1653; and since in explaining the arrangement which I have adopted I shall often have to refer to the volume in which they first apppeared, it will be well to give a particular account of it at once.

Bacon, in his last will, — after bequeathing his collection of speeches and letters to Bishop Williams and Sir Humphrey May, as being privy councillors, — commended the rest of his papers to the care of Sir John Constable and Mr. Bosvile. "Also I desire my executors, especially my brother Constable, and also Mr. Bosvile, presently after my decease, to take into their hands all my papers whatsoever, which are either in cabinets, boxes, or presses, and them to seal up till they may at their leisure peruse them."

What care, or whether any, was presently taken of these papers, I cannot learn. But it is probable that for fourteen months after Bacon's death, they remained locked up; — for so long it was before any one had authority to act; the executors named in the will refusing or delaying to assume their office, and letters of administration being granted on the 13th of July,

1627, to Sir Robert Rich and Mr. Thomas Meautys, two of the creditors; — and that then, or not long after, they were placed in the hands of Mr. Bosvile. This Mr. Bosvile, better known as Sir William Boswell, was sent, soon after Bacon's death, to the Hague; where he resided for several years as agent with the States of the United Provinces. He was knighted on the 18th of May, 1633, and died I believe in 1647. Whether all Bacon's remaining manuscripts were sent to him, or only a portion of them, is not known. What we know is that, among those which were sent, there were many philosophical pieces written in Latin; that he consulted Isaac Gruter about them; and that the result was a 12mo volume printed by Elzevir at Amsterdam in the year 1653, entitled *Francisci Baconi de Verulamio Scripta in Naturali et Universali Philosophiâ*, and containing these pieces following: —

1. A Prayer, headed *Temporis Partus Masculus, sive Instauratio magna imperii humani in universum.* The same in substance, and almost the same in expression, as the prayer which is introduced towards the end of the Preface to the *Instauratio* (Vol. I. p. 208.): placed here by itself on the blank side of the title-leaf, as if it were a motto to the volume — an office for which the heading makes it altogether inappropriate.

2. *Cogitata et Visa;* to which is added a Latin translation of Sir Thomas Bodley's letter to Bacon concerning that work. (p. 62.)

3. *Descriptio Globi Intellectualis.* (p. 75.)

4. *Thema Cœli.* (p. 154.)

5. *De Fluxu et Refluxu Maris.* (p. 178.)

6. *De Principiis atque Originibus secundum Fabulas Cupidinis et Cœli, &c.* (p. 208.)

These are all printed as separate pieces; each carrying its own title along the top of its own pages.

Then follow, under a general running title of *Impetus Philosophici:* —

7. *Indicia Vera de Interpretatione Naturæ.* (p. 285.) Merely the Præfatio to the *Novum Organum*, already printed in the first volume of this edition, p. 233.

8. *Partis Instaurationis Secundæ Delineatio et Argumentum.* (p. 293.) Printed as if it were a sequel to the last, the two forming one piece; which originally perhaps they did.

9. *Phænomena Universi, sive Historia Naturalis ad condendam Philosophiam.* (p. 323.) A fragment, consisting of a preface intended for the third part of the *Instauratio*, and a rudiment of the *Historia Densi et Rari*, with which it seems that Bacon then intended to begin his collection of histories.

10. *Scala Intellectus, sive Filum Labyrinthi.* (p. 379.) A preface intended for the fourth part of the *Instauratio.* Already printed. Supra p. 177.

11. *Prodromi sive Anticipationes Philosophiæ Secundæ.* (p. 385.) The preface intended for the fifth part of the *Instauratio.* Already printed. Supra p. 182.

12. *Cogitationes de Naturâ Rerum.* (p. 389.) The

piece with which in the present edition Part II. begins: infra p. 203.

13. A Preface, entitled *Franciscus Bacon Lectori.* (p. 431.) A first draught probably of the preface to the fourth part of the *Instauratio.*

14. *Filum Labyrinthi, sive Inquisitio legitima de Motu.* (p. 435.) A *skeleton* of an enquiry conducted upon the true method; that is to say, a complete list of the *titles* of the several processes of an investigation into the Form of Motion; followed by some general remarks, which may have been designed for the conclusion of the work which Bacon had in contemplation when he wrote the *Cogitata et Visa*, and intended to set forth the new method in an example.

15. *Franc. Baconi Aphorismi et Consilia, de auxiliis mentis et accensione luminis naturalis.* (p. 448.)

16. *De Interpretatione Naturæ Sententiæ XII.* (p. 451.) This and the preceding are rudiments of the *Novum Organum.*

17. *Tradendi Modus legitimus.* (p. 458.) This consists of two chapters; of which the first is the same as the first chapter of the *Temporis Partus Masculus;* the second another form of the *Redargutio Philosophiarum.* They are printed here (probably by mistake) as if they were a sequel to the *Sententiæ XII.*, with which they do not appear to be connected.

18. *De Interpretatione Naturæ Proœmium.* (p. 479.) This has been intended for a preface to the *In-*

stauratio, in some of its forms; probably to the *Temporis Partus Masculus*.

19. *Francisci Baconi Topica Inquisitionis de Luce et Lumine.* (p. 485.) Another copy, with a few slight variations, of the paper which has been already printed (Vol. IV. p. 133.) from Dr. Rawley's copy.

Of these nineteen pieces, the last thirteen are (as I have said) distinguished from the others by a general running title of *Impetus Philosophici;* the 2nd, 3rd, 4th, 5th, and 6th carrying each its own title on the top of its own pages; and to the whole volume is prefixed an address from Gruter to the reader, which contains all the information that is to be had about it; and which I must transcribe at length, the meaning being in some places so obscure that I can only guess at it.

LECTORI S. ISAACUS GRUTERUS.

QUÆ tibi damus Amice Lector, ad Universalem et Naturalem Philosophiam spectantia, ex Manuscriptis Codicibus, quos accurate recensuerat et varie emendarat author, me amanuense apographa sunt. Sola *Bodlei* epistola, quæ ad examen vocat *Cogitata et Visa*, per me ex Anglico facta Latina est, atque ex opere epistolarum Baconi, quæ tali idiomate circumferuntur, huc translata ob materiæ cognationem. Titulus quem frons libri præfert et totum complectitur opusculi in varias dissertationes secti argumentum, ab ipso *Verulamio* est; quem singulæ exhibent paginæ ex rerum tractatarum serie distinctum, a me, ut minus confunderet quærentem Lectorem indiculi defectus. Quicquid sequitur, ab eo loco cujus inscriptio est in ipso contextu *Indicia vera de interpre-*

tatione naturæ usque ad finem, donavi eo nomine *Impetus Philosophici*, quod ex familiaribus Viri magni colloquiis notassem, cum de istis chartis mecum ageret. Non aliter enim appellare solebat quicquid prioribus per titulos suos separatis connecteretur; ne quis imperfectum statim suspicetur quod defervescente *Impetu* non videt trahere syrma prolixæ tractationis. Omnia autem hæc inedita (nisi quod in editis paucissimis rara exstent quarundam ex his meditationum vestigia) debes, Amice Lector, Nobilissimo *Guil. Boswello*, ad quem ex ipsius Baconi legato pervenerant, cum aliis in politico et morali genere elaboratis, quæ nunc ex dono τοῦ μακαρίτου penes me servantur non diu premenda. Boswello inquam, viro nobilitate, prudentia insigni, varia eruditione, humanitate summa, et Oratori olim apud Batavos Anglo; cujus sancta mihi memoria est. Vale et conatibus nostris fave, qui mox plura daturi sumus Baconiana latine versa, maximam partem inedita; et συλλόγην adornamus epistolarum quas vir eminentissimus Hugo Grotius scripsit ad Belgas, Germanos, Italos, Suecos, Danos, Gallis exceptis, quas Clarissimus Sarravius Senator Parisiensis edidit. Rogantur itaque in quorum manus hæc inciderint, ut, si quid ejus notæ habent, aut sciunt unde haberi queat, ad typographum transmittant, et significent, cæteris jam collectis aggregandum.

From this statement we learn, first, that all the pieces in the volume are genuine, having been copied by Gruter from original manuscripts, bearing marks of revision and correction by Bacon himself; which manuscripts Gruter received directly from Sir William Boswell, to whom they had come directly from the executors; secondly, that Gruter had then in his possession, "non diu premenda," certain other writings of Bacon's (in Latin apparently) relating to morals and politics, which had come to Boswell along with

these; and thirdly, that he had in his hands (but whether derived from the same source or not we cannot say) some pieces written by Bacon in English, and most of them unpublished; and that of these he intended shortly to bring out a Latin translation.

With regard to the works contained in this volume, he seems to have had no further information to give. He has confined himself to the simple office of transcriber. The order in which they are arranged tells nothing either as to nature or date; and the running titles, which are his own device, seem to imply a distinction which, being untrue, can only introduce confusion. By assigning separate running titles to some of the pieces and printing all the rest under one general running title of *Impetus Philosophici*, any one would suppose that he meant to distinguish the first as in some way different in character from the last, — to separate the complete from the incomplete, for instance, the solid from the slight, or the deliberate and final judgment from the experimental and rudimentary essay; — whereas there is in fact no such difference to be found between the two: there being pieces among the last as complete in themselves as any among the first, and pieces among the first as incomplete as any among the last. And if I rightly understand Gruter's own explanation of his motive in making the distinction, — namely, lest the reader should impute the imperfection of the pieces to the fault of the editor instead of the *defervescens impetus* of the author, — it would even seem that he supposed the *Descriptio Globi Intellectualis* and the *De Principiis et Originibus* to be complete; which he could not pos

sibly have done if he had read them with his mind as well as with his eyes.

The fact probably is that the five pieces which stand first under separate titles — the *priora per titulos suos separata* — were found copied out in a book; and that the rest, — "quicquid prioribus, &c. *connecteretur*," — were in separate papers, tied up with it. We happen to know from the *Commentarius Solutus* that in the year 1608 this was the way in which Bacon's manuscripts were actually arranged, — that among his *Libri Compositionum* was one entitled *Scripta in Naturali et Universali Philosophiâ*, and that all his books "had pertaining to them fragments and loose papers of like nature with the books; and those likewise were bundled or laid up with the books." These last I presume it was, or such as these, that were called *Impetus Philosophici* by the "Vir Magnus" (that is, by Boswell, — for Bacon cannot be meant) with whom Gruter conferred about the papers: a description convenient enough for the purpose of distinguishing in a box of manuscripts the loose from the bound-up pieces, but worse than useless when introduced, especially with such imperfect explanation, into a printed book. In the present edition, the plan of which makes it necessary to separate and disperse the several pieces collected by Gruter under this title, the title itself is of course dispensed with. But if the reader wishes to know which of Bacon's posthumous writings he had taken pains to preserve by having them transcribed into a book, and which he had merely kept by him in loose bundles, — a point which it may sometimes be of use to ascertain, — he will find in the table of contents which I have just given all the information

on the subject that can be extracted from Gruter's volume.

The duty of *transcriber* Gruter appears to have performed tolerably well; there are but a few places in which the text is manifestly corrupt; but since he has attempted nothing more, it is to be regretted that he has left us without any information as to the fate of the original manuscripts; not one of which, I believe, is known to be in existence. There is not one of them which would not be well worth examining, if it could be found; not only for the correction of the text, but because some interesting questions as to date might possibly be cleared up by help of the interlineations and alterations.

Another question well worth asking is, what became of those moral and political pieces which Gruter had received from Boswell, and had by him in 1653, and intended to publish? I cannot hear that he ever did publish anything answering the description; and unless he transferred them to Dr. Rawley to be included in the *Opuscula* (1658), which does contain a few things of the kind, they remain to be accounted for.

The unpublished *English* pieces, of which he announces his intention to bring out a Latin translation (an intention which I cannot learn that he ever fulfilled), may have been only copies of those which were published by Dr. Rawley in 1657. These were afterwards translated into Latin by S. J. Arnold, and included (see *Acta Eruditorum*, vol. xiii. anno 1694, p. 400.) in an edition of Bacon's *Opera Omnia* which was published at Leipsic in that year.

In 1695 they were reprinted at Amsterdam by H. Wetstenius in a separate volume; with the title *Francisci Baconi, &c., Opuscula historico-politica, Anglice olim conscripta, et nuper Latinitate donata à Simone Joanne Arnoldo, Ecclesiæ Sonnenbrugensis Inspectore.*

J. S.

COGITATIONES

DE

NATURA RERUM.

PREFACE

TO THE

COGITATIONES DE NATURA RERUM.

THIS piece was printed by Gruter among the *Impetus Philosophici;* from which we may probably conclude that it had not been transcribed into the volume of *Scripta in Naturali et Universali Philosophiâ:*[1] but that is all. There is nothing to determine the date of composition, unless it be the absence of any allusion to the new star in Ophiuchus in the place where the new star in Cassiopeia is mentioned. See note, § x. The value of the argument will be more easily understood by comparing the passage in question with a passage of the same import in a work, obviously later, where both these stars are mentioned together. In both cases the question under discussion is the immutability of the heavens. In the *Cogitationes de Naturâ Rerum*, of which the date is unknown, we find, "... mutationes in regionibus cœlestibus fieri, ex cometis quibusdam satis liquet; iis dico qui certam et constantem configurationem cum stellis fixis servarunt; qualis fuit ille qui in Cassiopeâ nostrâ ætate apparuit." This star in Cassiopeia appeared in 1572. But another of the same kind, and no less remarkable, appeared in Sep-

[1] See above, p. 194.

tember 1604. It is said to have been brighter, when first seen, than Jupiter;[1] and though its brightness diminished afterwards, it was distinctly visible for more than a year. It attracted so much attention as to be made the subject of three lectures of a popular character, given by Galileo to crowded audiences; and it is difficult to believe either that Bacon did not know of it (he being then 44 years old, and busy at the time with the *Advancement of Learning*, and quite understanding the significance of the phenomenon;) or that, if he did, he could have forgotten to mention it when speaking of the other. Accordingly, in the *Descriptio Globi Intellectualis*, which we know to have been written about the year 1612, the passage which I have just quoted appears in a new form. "Id enim [sc. admirandas in cœlo accidere mutationes atque insolentias] perspicitur in cometis sublimioribus, iis nimirum qui et figuram stellæ induerunt absque comâ, neque solum ex doctrinâ parallaxium supra lunam collocati esse probantur, sed configurationem etiam certam et constantem cum stellis fixis habuerunt, et stationes suas servarunt, neque errones fuerunt; quales ætas nostra *non semel* vidit; primo in Cassiopeâ, *iterum non ita pridem in Ophiucho.*"

That when Bacon wrote the tenth *Cogitatio* he *had not heard* of the appearance of this second new star, may be assumed with considerable confidence. The only question is whether such a phenomenon could have been long known to the astronomers of his time, without his hearing of it; of which I can only say that it seems unlikely, and that, in the absence of all

[1] Maestlin, quoted in the Life of Galileo, *Library of Useful Knowledge*, p. 16.

evidence to the contrary, the presumption must be that these *Cogitationes* were composed before 1605. That they were composed before the appearance of the new star in Cygnus, cannot be so safely inferred. That star was much less conspicuous; and it is a fact that Galileo himself, treating this very same argument, mentions both the others without making any allusion to it. See Dial. dei Massimi Sistemi, p. 59. ed. Flor. 1842.

The notes to this piece are Mr. Ellis's.

J. S.

COGITATIONES DE NATURA RERUM.

COGITATIO I.

De sectione corporum, continuo, et vacuo.

Doctrina Democriti de atomis aut vera est, aut ad demonstrationem utiliter adhibetur. Non[1] facile enim est naturæ subtilitatem genuinam, et qualis in rebus ipsis invenitur, aut cogitatione complecti aut verbis exprimere, nisi supponatur atomus. Accipitur autem duobus sensibus atomus, non multum inter se diversis. Aut enim accipitur pro corporum sectionis sive fractionis termino ultimo sive portione minima; aut pro corpore quod vacuo caret. Quod ad primum attinet, hæc duo posita tuto et certo statui possunt. Alterum, inveniri in rebus dispertitionem et comminutionem, longe ea quæ sub adspectum cadit subtiliorem. Alterum, eam tamen infinitam non esse, nec perpetuo divisibilem. Si quis enim diligenter attendat, reperiet rerum minutias in corporibus continuatis, eas quæ in corporibus fractis et discontinuatis inveniuntur subtilitate longe vincere. Videmus enim parum croci in aqua infusum et agitatum, puta dolium aquæ ita inficere, ut ab alia aqua pura etiam visu distingui possit. Quæ certe dispertitio croci per aquam, subtilitatem exquisitissimi pulveris superat. Quod manifestum fiet, si tan-

[1] *Nam* in Gruter's copy. — *J. S.*

tundem pulveris ligni Brasilii, vel balaustiorum, vel alicujus rei optime coloratæ (quæ tamen croci lentorem ad se in liquoribus aperiendum et incorporandum non habeat) immisceas. Itaque ridiculum erat, atomos pro parvis illis corpusculis quæ sub radiis solis conspiciuntur accipere. Ea enim pulveris instar sunt; atomum autem, ut ipse Democritus aiebat, nemo unquam vidit, aut videre possit. Sed ista rerum dispertitio in odoribus multo magis mirabilem se ostendit. Etenim si parum croci dolium aquæ colore, at parum zibethi cœnaculum amplum odore, imbuere et inficere potest, et subinde aliud, et rursus aliud. Neque quisquam sibi fingat, odores, luminis more aut etiam caloris et frigoris, absque communicatione substantiæ diffundi; cum notare possit, odores etiam rebus solidis, lignis, metallis, adhærescere, idque ad tempus non exiguum; posse etiam frictione, lavatione, ab iisdem discuti et purgari. Verum in hisce et similibus, quod processus infinitus non sit, nemo sanus contradixerit; cum intra spatia et limites, et corporum quantitates, hujusmodi dispertitio sive diffusio cohibeatur: ut in exemplis antedictis evidentissimum est. Quod ad secundum sensum atomi attinet, quod vacuum præsupponit, atomumque ex privatione vacui definit; bona et seria diligentia Heronis fuit, quæ[1] vacuum coacervatum negavit, vacuum commistum asseruit.[2] Cum enim perpetuum corporum nexum cerneret, neque inveniri prorsus aut assignari spatium aliquod quod corpore vacet; et multo magis, cum corpora gravia et ponderosa sursum ferri, et naturas suas quoquo modo deponere et violare potius quam divulsionem absolu-

[1] So in Gruter's copy. — *J. S.*

[2] See note on *Nov. Org.* II. 48. [Vol. I. p. 513.]

tam a corpore contiguo patiantur, videret; naturam a vacuo majoris notæ, sive coacervato, abhorrere prorsus statuit. Contra, cum eandem corporis materiam contrahi, et coarctari, et rursus aperiri et dilatari perspiceret, et spatia inæqualia, interdum majora interdum minora, occupare et complere; non vidit quomodo hujusmodi ingressus et egressus corporum in locis suis fieri possit, nisi propter vacuum admistum, minus videlicet corpore compresso, plus relaxato. Necesse enim esse, contractionem istam per unum ex his tribus modis fieri; aut eo quem diximus, nempe quod vacuum pro ratione contractionis excludatur; aut quod aliud aliquod corpus prius intermixtum exprimatur; aut quod sit quædam naturalis (qualis qualis ea sit) corporum condensatio et rarefactio. Atque quod ad corporis tenuioris expressionem attinet, ista ratio nullum exitum habere videtur. Nam verum est, spongias, et hujusmodi porosa, expresso aëre contrahi. De aëre ipso autem manifestum est per plurima experimenta, eum [1] spatio notabili contrahi posse. Num ergo et ipsius aëris subtiliorem partem exprimi putandum est? et deinceps hujusmodi partis aliam, et sic in infinitum? Nam adversissimum tali opinioni est, quod quo tenuiora corpora sint, eo majorem contractionem sustineant; cum contra fieri oporteret, si contractio per expressionem partis tenuioris fieret. Atque de illo altero modo, corpora scilicet eadem, nec alias mutata, tamen magis et minus in raritate aut densitate recipere, non multum laborandum est. Positivum enim quiddam videtur esse, et ratione surda et inexplicata niti, qualia sunt fere Aristotelis pronuntiata. Restat itaque tertius ille modus, qui vacuum supponit. Quod si

[1] *cum* in Gruter's copy. — *J. S.*

illud quis objiciat: durum videri, et fere incredibile, ut vacuum admistum sit, cum corpus ubique reperiatur; is si exempla quæ modo adduximus, aquæ croco, vel aëris odoribus infecti, animo sedatiore consideret, facile perspiciet nullam partem posse assignari aquæ ubi crocus non sit, et tamen manifestum esse ex comparatione croci et aquæ antequam miscerentur, corpus aquæ corpus croci multis numeris excedere. Quod si id in diversis corporibus invenitur, multo magis in corpore et vacuo hoc fieri putandum est. Verum in ea parte, Heronis, utpote hominis mechanici, contemplatio, illa Democriti, philosophi clarissimi, inferior fuit: quod Hero, quia hic apud nos in nostro isto orbe vacuum coacervatum non reperit, ideo illud simpliciter negavit. Nil enim impedit, quominus in regionibus ætheris, ubi proculdubio majores sunt corporum expansiones, etiam vacuum coacervatum sit. In iis autem inquisitionibus et similibus semel monitum sit, ne quis propter tantam naturæ subtilitatem confundatur et diffidat. Cogitet enim et unitates et summas rerum ex æquo supputationi submitti. Tam facile enim quis mille annos dixerit aut cogitarit,[1] quam mille momenta; cum tamen anni a multis momentis constituantur. Neque rursus existimet aliquis, hæc potius speculationis curiosæ esse, quam ad opera et usum referri. Videre enim est omnes fere philosophos et alios qui in experientia et rebus particularibus sedulo versati sunt et naturam ad vivum dissecuerunt, in hujusmodi inquisitiones incidere, licet eas feliciter non peragant. Neque alia subest causa potentior et verior, ob quam philosophia quam habemus effectuum sit sterilis, nisi quod verborum et notionum

[1] *cogitaret* in Gruter's edition. — *J. S.*

vulgarium subtilitates captavit; naturæ subtilitatem non persecuta est, nec inquirere constituit.

II.

De æqualitate ac inæqualitate Atomorum sive Seminum.

Pythagoræ inventa et placita talia ex majore parte fuere, quæ ad ordinem potius quendam religiosorum fundandum, quam ad scholam in philosophia aperiendam, accommodata essent; quod et eventus comprobavit. Ea enim disciplina plus in hæresi Manichæorum et superstitione Mahumeti quam apud philosophos valuit et floruit. Opinio tamen ejus, mundum ex numeris constare, eo sensu accipi potest, ut ad naturæ principia penetret. Duplex enim est, atque adeo esse potest, opinio de atomis sive rerum seminibus: una Democriti, quæ atomis inæqualitatem et figuram, et per figuram situm, attribuit; altera fortasse Pythagoræ, quæ eas omnino pares et similes esse asseruit.[1] Qui enim æqualitatem atomis assignat, is omnia in numeris necessario ponit; qui autem reliqua attributa admittit, is naturas primitivas atomorum singularium præter numeros sive rationes coitionum adhibet. Activa autem quæstio quæ huic speculativæ respondet eamque determinare potest, ea est quam etiam Democritus adducit; utrum omnia ex omnibus fieri possint.[2] Quod cum ille a ratione alienum putasset,

[1] It is possible that Bacon may have been led to suggest this view of the Pythagorean philosophy by a passage in Stobæus, *Eclog.* i. 16. It is there said that Ecphantus, a Pythagorean of Syracuse, took as first principles atoms and vacuum. *τὰς γὰρ Πυθαγορικὰς μονάδας οὗτος πρῶτος ἀπεφήνατο σωματικάς.* But as metaphysical conceptions have, so to speak, a natural tendency to assume a merely physical character, the idea of a parallel between Democritus and Pythagoras may, it is not improbable, have occurred to him independently of this or any similar passage.

[2] See Lucretius, i. 784.

atomorum diversitatem tenuit. Nobis vero ea quæstio non bene instituta nec quæstionem priorem premere videtur, si de transmutatione immediata corporum intelligatur. Verum utrum etiam per debitos circuitus et mutationes medias universa non transeant, ea demum quæstio legitima est. Dubium enim non est, semina rerum, licet sint paria, postquam se in certas turmas et nodos conjecerint, corporum dissimilium naturam omnino induere, donec eædem turmæ aut nodi dissolvantur; adeo ut compositorum natura et affectus transmutationi immediatæ non minori impedimento ac obici, quam simplicium, esse possit. Verum Democritus in corporum principiis investigandis acutus; in motuum autem principiis examinandis sibi impar et imperitus deprehenditur; quod etiam commune vitium omnium philosophorum fuit. Atque hujus de qua loquimur inquisitionis de prima conditione seminum sive atomorum utilitas, nescimus an non sit omnino maxima; ut quæ sit actus et potentiæ suprema regula, et spei et operum vera moderatrix. Etiam alia inquisitio inde fluit, cujus utilitas complexu minor, sed rebus et operibus propior est. Ea est de separatione et alteratione; hoc est, quid per separationem fiat, et quid alia ratione. Familiaris enim est animo humano error, qui etiam a chymistarum philosophia magnum robur et incrementum accepit; ut ea separationi deputentur, quæ alio spectent. Exempli gratia; cum aqua in vaporem transit, facile quis opinetur partem aquæ subtiliorem emitti, crassiorem subsistere; ut in ligno videre est, ubi pars in flamma et fumo evolat, pars in cinere manet. Simile quiddam et in aqua fieri quis putet, licet non tam manifesto. Quamvis enim tota aqua quandoque ebul-

lire et consumi videatur, tamen fæces quasdam ejus, tanquam cinerem, vasi adhærescere posse. Verum et ista ratio cogitationem fallit. Certissimum enim est, totum corpus aquæ in aërem posse mutari, et si quid vasi adhærescat, id non ex delectu et separatione partis crassioris, sed forte ut aliqua pars (licet pari omnino cum ea quæ evolat substantia) situ vas tetigerit, evenire; idque exemplo argenti vivi elucescit, quod totum fit volatile, et rursus totum absque diminutione vel tantilla consistit. Etiam in oleo lampadum et sevo candelarum, totum a pingui fit volatile, nec aliqua fit incineratio; nam fuligo post flammam, non ante flammam, gignitur; et flammæ cadaver, non olei aut sevi sedimentum est. Atque hoc aditum quendam ad Democriti opinionem de diversitate seminum sive atomorum labefactandam præbet. Aditum, inquam, in natura; nam in opinione aditus ille est multo mollior et blandior, quod philosophia vulgaris materiam suam commentitiam ad omnes formas æquam et communem fingit.

III.

De negligentia veterum in inquisitione de Motu et Moventibus rerum Principiis.

Inquisitionem de Natura in Motu contemplando et examinando maxime collocare, ejus est qui opera spectet. Quieta autem rerum principia contemplari aut comminisci, eorum est qui sermones serere et disputationes alere velint. Quieta autem voco principia, quæ docent ex quibus res conflentur et consistant, non autem qua vi et via coalescant. Neque enim ad agendum et potestatem sive operationem humanam amplificandam sufficit, aut magnopere attinet, nosse ex quibus

res constent, si modos et vias mutationum et transformationum ignores. Nam sumpto exemplo a mechanicis[1] (a quarum[2] phantasia celebres illæ de principiis rerum inquisitiones fluxisse videntur), an forte qui simplicia theriacam ingredientia novit, is pro certo theriacam componere potest? Aut qui sacchari, vitri, panni, materialia recte descripta apud se habet, num propterea artem quæ ad eorum præparationem et effectionem pertinet tenere videtur? Atque in hujusmodi tamen principiis mortuis investigandis et examinandis hominum speculationes præcipue occupatæ sunt; ac si quis cadaveris naturæ anatomiam inspicere, non naturæ vivæ facultates et virtutes inquirere, sibi proponat et destinet. De moventibus autum rerum principiis sermo fere in transitu habetur; ut omnem admirationem superet, si intueamur quam negligenter et dissolute res omnium maxima et utilissima inquiratur et tractetur. Etenim si cogitationem de iis quæ dicuntur paulisper suscipiamus; num stimulus materiæ per privationem? num efformatio materiæ ad ideam? num aggregatio particularum similium? num agitatio fortuita atomorum in vacuo? num lis et amicitia? num cœli et terræ impressiones reciprocæ? num elementorum commercium per qualitates symbolizantes?[3] num influxus cœlestium? num sympathiæ et antipathiæ rerum? num occultæ et specificæ virtutes et proprietates? num fatum, fortuna, necessitas? num, inquam, hujusmodi generalia, quæ nil aliud sunt quam spectra et simulachra in superficie rerum,

[1] This word is obviously a wrong reading for *medicis*.

[2] Read *quorum*.

[3] Those elements are said to symbolize, or to be allied, which have a primary quality in common. Thus air symbolizes with fire, inasmuch as both are hot; and with water, inasmuch as like water it is moist. In the preceding clauses Bacon alludes successively to Aristotle, Plato, Anaxagoras, Democritus, Empedocles, and Parmenides.

veluti in aquis, natantia et ludentia, humanum genus beabunt aut opes humanas efficient auctiores? Ista enim phantasiam implent, vel inflant potius; sed nil prorsus ad operum effectionem, corporum mutationem, aut motuum regimen faciunt. Atque rursus, de motu naturali et violento, de motu ex seipso et aliunde, de terminis motuum, argutari et subtilitates captare; et hæc quoque nil admodum de corpore naturæ stringunt; sed potius in cortice describuntur. Itaque his missis, vel ad populares sermones damnatis et relegatis, illi demum rerum appetitus et inclinationes investigandæ sunt, a quibus ista, quam videmus, tanta effectuum et mutationum varietas in operibus et naturæ et artis conflatur et emergit. Atque tentandum ut naturæ, veluti Proteo, vincula injiciamus. Sunt enim genera motuum recte inventa et discreta, vera Protei vincula. Nam prout motuum, id est, incitationum et cohibitionum, stimuli et nodi adhibentur, ad illud sequitur materiæ ipsius conversio et transformatio.

IV.

De divisione vulgari Motus, quod sit inutilis, et minus acuta.

Divisio Motus recepta in philosophia popularis videtur et absque fundamento, ut quæ rem per effectus tantum dividit; atque ad hoc, ut per causas sciamus, nihil conducit. Nam generatio, corruptio, augmentatio, diminutio, alteratio, latio ad locum, nil aliud quam opera et effectus motuum sunt;[1] qui cum ad manifestam rerum muta-

[1] From this enumeration it seems that Bacon was not aware that generation and corruption were not regarded by Aristotle as kinds of motion. But see Arist. *Physic.* v. 1. There are, according to Aristotle, three kinds of κίνησις or motion, corresponding to the three categories which admit of contrariety; namely, πόσον, ποῖον, and ποῦ. To the first corresponds in-

tionem pervenerunt quæ populari notæ subjacet, tum demum hisce nominibus (pingui satis contemplatione) insigniuntur. Neque enim dubitamus quin hoc sibi velint: cum corpora per motum (cujuscunque sit generis) eo usque processerint ut formam novam teneant vel veterem ponant (quod veluti periodus quædam est, et justi spatii confectio), id motum *generationis* et *corruptionis* nominari; sin autem, manente forma, quantitatem tantummodo et dimensionem novam adipiscantur, id motum *augmentationis* et *diminutionis* dici; sin,[1] manente etiam mole et claustris sive circumscriptione, tamen qualitate, actionibus, et passionibus mutentur, id motum *alterationis* appellari; sin, manente utique et forma et mole et quantitate, locum et nil aliud mutent, id per motum *lationis* significari. Verum hæc omnia, acutius et diligentius inspicienti, mensura motus sunt, et periodi sive curricula quædam motuum, et veluti pensa; non veræ differentiæ; cum quid factum sit designent, at rationem facti vix innuant. Itaque hujusmodi vocabula docendi gratia sunt necessaria, et dialecticis rationibus accommodata, naturalis autem scientiæ egentissima. Omnes enim isti motus compositi sunt, et decompositi, et multipliciter compositi; cum perite contemplantibus ad simpliciora penetrandum sit. Nam principia, fontes, causæ, et formæ motuum, id est omnigenæ materiæ appetitus et passiones, philosophiæ debentur; ac deinceps motuum impressiones sive impulsiones; fræna et reluctationes; viæ et obstructiones; alternationes et mixturæ; circuitus et catenæ; denique universus motuum processus. Neque

crement or decrement; to the second, alteration; and to the third, local motion.

[1] [*sic* in Gruter's edition; which,] as M. Bouillet has observed, ought to be *sin*.

enim disputationes animosæ, aut sermones probabiles, aut contemplationes vagæ, aut denique placita speciosa, multum juvant. Sed id agendum, ut modis debitis, et ministerio naturæ convenienti, motum quemcunque in materia susceptibili excitare, cohibere, intendere, remittere, multiplicare, ac sopire et sistere possimus; atque inde corporum conservationes, mutationes, et transformationes præstare. Maxime autem ii motus sunt inquirendi, qui simplices, primitivi, et fundamentales sunt, ex quibus reliqui conflantur. Certissimum enim est, quanto simpliciores motus invenientur, tanto magis humanam potestatem amplificari, et a specialibus et præparatis materiis liberari, et in nova opera invalescere. Et certe quemadmodum verba sive vocabula omnium linguarum, immensa varietate, e paucis literis simplicibus componuntur; pari ratione universæ rerum actiones et virtutes a paucis motuum simplicium naturis et originibus constituuntur. Turpe autem fuerit hominibus, propriæ vocis tintinnabula tam accurate explorasse, ad naturæ autem vocem tam illiteratos esse; et more prisci seculi (antequam literæ inventæ essent) sonos tantum compositos et voces dignoscere, elementa et literas non distinguere.

V.[1]

De Quanto Materiæ certo, et quod[2] *mutatio fiat absque interitu.*

Omnia mutari, et nil vere interire, ac summam materiæ prorsus eandem manere, satis constat. Atque

[1] A manuscript in the British Museum (Add. 4258.), — for a full account of which see my Preface to the *Cogitationes de Scientia Humanâ*, the first piece in the third Part, — contains the fifth, sixth, seventh, and tenth of these Cogitationes. It has a few different readings, which I will point out here, though they are almost all mistakes. — *J. S.*

[2] *quæ* in MS.

ut omnipotentia Dei opus erat, ut aliquid crearetur e nihilo; ita et similis omnipotentia requiritur, ut aliquid redigatur in nihilum. Id sive per destitutionem virtutis conservatricis sive per actum dissolutionis fiat, nihil ad rem: tantum necesse est, ut decretum intercedat Creatoris. Hoc posito, ne cogitatio abstrahatur aut materia aliqua fictitia intelligatur, etiam illud significamus; eam a nobis introduci materiam, atque ea natura investitam, ut vere dici possit, huic corpori plus materiæ adesse, illi autem (licet eandem mensuram expleant) minus. Exempli gratia, plumbo plus, aquæ minus, aëri multo minus: neque hoc solum indefinite et ratione incerta et surda, sed præcise; adeo ut calculos hæc res pati possit, veluti plus duplo, triplo, et similiter. Itaque si quis dicat aërem ex aqua fieri posse aut rursus aquam ex aëre, audiam; si vero dicat similem mensuram aquæ in similem mensuram aëris verti posse, non audiam; idem enim est ac si dixisset aliquid posse redigi in nihilum. Similiter e converso, si dicat datam mensuram aëris (exempli gratia vesicam contenti certi aëris plenam) in similem mensuram aquæ verti posse, idem est ac si dicat aliquid fieri posse ex nihilo. Ex his itaque positis, tria præcepta sive consilia ad usum derivare jam visum est; ut homines peritius, et propter peritiam felicius, cum natura negotientur. Primum hujusmodi est, ut homines frequenter naturam de rationibus suis reddendis interpellent; hoc est, cum corpus aliquod quod prius sensui manifestum erat aufugisse et disparuisse videant, ut non prius rationes admittant[1] aut liquident, quam demonstratum eis fuerit quo tandem corpus illud migraverit, et ad quæ receptum sit. Hoc, ut nunc sunt res, negligentissime fit,

[1] *non admittant* in MS.

et contemplatio plerumque cum aspectu desinit; adeo ut flammæ, rei vulgatissimæ, receptum homines non norint; quandoquidem eam in corpus aëris mutari falsissimum sit. Secundum hujusmodi, ut cum homines[1] considerent necessitatem naturæ prorsus adamantinam quæ materiæ inest, ut se sustentet nec in nihilum cedat aut solvatur, illi rursus nullum genus vexationis et agitationis materiæ prætermittant, si ultimas ejus operationes et obstinationes detegere atque educere velint. Atque hoc consilium non admodum artificiosum certe videri possit; quis negat? sed utile tamen quiddam videtur, neque nihil in eo est. Veruntamen, si placet, etiam nunc parum observationis huic rei adspergamus. Itaque sic habeto.[2] Maximum certe homini, sive operanti sive experienti, impedimentum occurrit, quod materiæ massam certam absque diminutione aut accessione servare, et premere et subigere vix licet; sed separatione facta ultima vis eluditur. Separatio autem duplex intervenit, aut quod pars materiæ evolet, ut in decoctione: aut saltem quod secessio fit, ut in flore lactis. Intentio itaque mutationis corporum profundæ et intimæ non alia est, quam si materia omnino debitis modis vexetur; sed tamen istæ duæ separationes nihilominus interim prohibeantur. Tum enim materia vere constringitur, ubi fugæ omnis via intercipitur. Tertium denique hujusmodi, ut homines cum corporum alterationes in eadem materiæ massa, neque aucta neque diminuta, fieri videant, primum eo errore phantasiam liberent, qui alte hæret; alterationem nempe tantummodo per separationem fieri; deinde ut sedulo et perite distinguere incipiant de alterationibus, quando ad separationem referri debeant; quando ad disordinationem tantum,

[1] *homines cum* in MS. [2] *habete* in MS.

et variam positionem partium absque alia separatione; quando ad utramque. Neque enim (credo) cum pyrum immaturum et acerbum manibus[1] fortius attrectamus, contundimus, et subigimus, unde illud dulcedinem acquirit; aut cum succinum vel gemma in pulverem subtilissimum redacta colorem deponunt; materiæ pars notabilis deperditur; sed tantum partes corporis in nova positione constituuntur. Restat ut errorem quendam ex opinionibus hominum evellamus, cujus ea vis est, ut si fides ei adhibeatur,[2] aliqua ex his quæ diximus pro desperatis haberi possint. Vulgaris enim opinio est, rerum spiritus, cum ad intensiorem quendam gradum tenuitatis per calorem evecti[3] sunt, etiam in vasis solidissimis (puta argenti, vitri), per occultos eorundem poros et meatus evolare;[4] quod minus verum est. Neque enim aër aut spiritus, licet accedente calore rarefactus, non flamma ipsa, tam libenter se comminuit, ut per hujusmodi poros exitum sibi quærere aut facere sustineat. Verum ut nec aqua per rimam valde parvam, ita nec aër per hujusmodi poros effluit. Nam ut aër aqua longe tenuior, ita et tales pori rimis conspicuis longe subtiliores sunt; neque opus haberet[5] sub vase operto suffocari, si hujusmodi perspirationes illi ullo modo præsto essent aut competerent. Exemplum autem quod adducunt miserum est, vel potius miserandum; ut sunt pleræque contemplationes vulgaris philosophiæ, cum ad particularia ventum est.[6] Aiunt enim, si charta inflammata in poculum mittatur, et subito os poculi super vas aquæ convertatur, aquam sursum trahi; propterea quod postquam flamma, et aër per

[1] *per manus* in MS.
[2] *exhibeatur* in MS.
[3] *evectæ* in MS.
[4] *evolari* in Gruter's edition. — *J. S.*
[5] *haberet flamma* in MS.
[6] *sit* in MS.

flammam rarefactus, quæ spatii aliquantum impleverant, per poros vasis exhalaverint, restare ut corpus aliquod succedat. Idem in ventosis fieri, quæ carnes trahunt. Atque de successione aquæ vel carnis bene sentiunt; de causa quæ præcedit, imperitissime. Neque enim est aliqua corporis emissio, quæ spatium præbet, sed sola corporis contractio. Corpus enim in quod flamma recidit, longe minus spatium complet, quam flamma antequam exstingueretur. Hinc fit illud inane, quod successionem desiderat. Atque in ventosis hoc evidentissimum est. Nam cum eas fortius trahere volunt, spongia aquæ frigidæ infusa illas tangunt, ut per frigus aër interior condensetur, et se in minus spatium colligat. Itaque demimus certe hominibus eam solicitudinem, ne de spirituum tam facili evolatione laborent: cum et illi spiritus, quos sæpe desiderant, odorum, saporum, similium, non semper[1] extra septa evolent,[2] sed intra confundantur;[3] hoc certissimum est.

VI.

De Quiete Apparente, et Consistentia, et Fluore.

Quod quædam quiescere videantur et motu privari, id secundum totum aut integrum recte videtur, secundum partes autem hominum opinionem fallit. Quies enim simplex et absoluta, et in partibus et in toto,[4] nulla est; sed quæ esse putatur, per motuum impedimenta, cohibitiones, et æquilibria efficitur. Exempli gratia, cum in vasis[5] in fundo perforatis, quibus hortos irrigamus, aqua (si os vasis obturetur) ex foraminibus illis non effluit, id per motum retrahentem non per naturam quiescentem fieri perspicuum est. Aqua enim

[1] *semper* om. MS. [2] *evolant* in MS. [3] *confunduntur* in MS.
[4] *et in partibus et in toto* om. MS. [5] *vasibus* in MS.

tam contendit descendere, quam si actu suo potiatur; sed cum in summitate vasis non sit quod succedat, aqua in imo ab aqua in summo retrahitur et vim patitur. Si quis enim alterum infirmiorem in lucta teneat, ut se movere non possit, atque ille nitatur tamen[1] sedulo, non propterea minor est motus renitentiæ, quia non prævalet, et a motu fortiori ligatur. Hoc autem quod dicimus de falsa quiete, et in rebus innumeris utile cognitu est, et non minimum lucis præbet in inquisitione naturæ solidi et[2] liquidi, sive consistentiæ et fluoris. Solida enim videntur in positione sua manere et quiescere, liquida autem moveri et confundi. Neque enim columna ex aqua, aut alia effigies exstrui potest, ut de[3] ligno vel lapide. Itaque in promptu est opinari, partes aquæ superiores contendere (motu, quem appellant, naturali) ut defluant; partes autem ligni non item. Atqui hoc verum non est; cum idem insit motus partibus ligni quæ in summo collocantur, ut deorsum ferantur, qui aquæ; idque in actum perduceretur, nisi ligaretur et retraheretur iste motus a motu potiore. Is autem est certe appetitus continuitatis, sive separationis fuga; quæ et ipsa tam aquæ quam ligno competit, sed in ligno est motu gravitatis fortior, in aqua debilior. Nam quod ex hujusmodi motu etiam quæ liquida sunt participent, id manifestum est. Videmus enim in bullis aquæ, ad separationem evitandam, aquam se in pelliculas conjicere, in hemisphærii formam confictas. Videmus etiam in stillicidiis, aquam ut aquæ continuetur, in filum exile se producere et attenuare, quoad sequens aqua suppetat; sin autem deficiat aqua ad continuationem, tum se in guttas ro-

[1] So the MS. In Gruter's edit. *tamen* comes after *propterea*.
[2] *vel* in MS. [3] *et* in MS.

tundas recipere, quarum diameter filo illo priore sit multo major.[1] Simili modo videmus, aquam comminutionem magis exquisitam ægre pati, cum ex foraminibus et rimis (si subtiliores sint) naturali suo pondere absque concussione non effluat. Quare constat appetitum continuitatis etiam liquidis inesse, sed debilem. At contra in rebus solidis viget, et motui naturali sive gravitati prædominatur. Si quis enim existimet, in columna ligni vel lapidis superiores partes non diffluere cupere, sed se in eodem plane statu sustinere; is facile se corriget, si consideret columnam, sive similia, si altitudo ejus ad latitudinem basis non sit proportionata, sed modum excedat, stare non posse, sed devexo pondere ferri; adeo ut structuris prælatis necesse sit ut ad pyramidis formam inclinent, et sint versus summitatem angustiores. Qualis autem sit ea natura quæ appetitum istum continuitatis intendat aut remittat, non facile inquirenti occurret. Illud fortasse suggeretur, partes solidorum esse magis densas et compactas; liquidorum[2] magis raras et solutas; aut liquidis subesse spiritum, quod fluoris sit principium, qui in solidis desit; et hujusmodi. Sed neutrum horum veritati consonum est. Manifestum enim est, nivem et ceram, quæ secari et fingi et impressiones recipere possunt, argento vivo aut plumbo liquefacto longe esse rariora, ut in ratione ponderum evincitur. Quod si quis adhuc insistat, fieri posse ut nix aut cera, licet sit (in toto) argento vivo rarior, tamen habere possit partes magis clausas et compactas; verum quia sit corpus spongiosum et cava multa et aërem recipiat, ideo in summa effici leviorem; ut in pumice fit, qui cum pro ratione molis sit fortasse ligno levior, tamen si utrumque in

[1] *diametrum* and *majus* in MS. [2] *liquorum* in MS.

pulverem redigatur, pulverem pumicis pulvere ligni futurum graviorem, quia cavitates illæ non amplius adsint; hæc bene notata et objecta sunt. Sed quid ad nivem et ceram colliquatam dicent, ubi jam cavitates expletæ sunt; vel quid ad gummi corpora, mastichen, et similia, quæ cavitates istas manifestas non habent, et tamen sunt pluribus liquoribus leviora? Quod autem de spiritu afferunt, per cujus vim et impetum res fluant; id certe primo intuitu probabile est, et notionibus communibus familiare; reipsa autem durius est et magis erroneum; cum veræ rationi non solum non innitatur, sed fere opponatur. Spiritus enim ille, quem dicunt, revera (quod mirum fortasse dictu) consistentiam inducit, non fluorem. Quod et optime in instantia nivis cernitur, quæ cum ex aqua et aëre compositum corpus sit, cumque et aqua et aër seorsim fluant, in mixtura tamen consistentiam adipiscitur. Quod si quis objiciat, id evenire posse ex condensatione aqueæ partis per frigus, et non ab interpositione aëris; is se corriget, si animadvertat etiam spumam corpus simile nivi esse, quod tamen a frigore nullo modo condensetur. Sin adhuc urgeat, et in spuma præcedere[1] condensationem, non a frigore, sed tamen ab agitatione et percussione; is pueros consulat, qui ex levi aura per fistulam sive calamum inspirata, et aqua (ob parum saponis admixtum) paulo tenaciore, miram et turritam bullarum structuram conficiunt. Res autem sic se habet; corpora ad tactum corporis amici sive similis se solvere et laxare; ad tactum autem corporis dissentientis se stringere et sustinere. Itaque appositionem corporis alieni esse consistentiæ causam. Sic videmus oleum aquæ admistum, ut fit in unguentis, liquiditatem, quæ et in

[1] M. Bouillet reads *procedere*, which is doubtless right.

aqua et in oleo antea vigebat, quadantenus exuere. Contra videmus, papyrum aqua madefactam se solvere, et consistentiam (quæ ob aërem antea in poris admistum valida erat) deponere; oleo vero madefactam, minus; quia oleum papyro minus consentiat. Idem quoque in saccharo videmus, et similibus, quæ ad aquam vel vinum intromittenda se laxant, neque solum cum liquores illis incumbunt, sed eosdem quoque sugunt et sursum trahunt.[1]

VII.

De consensu corporum, quæ sensu prædita sunt, et quæ sensu carent.

Passiones corporum, quæ sensu dotantur, et quæ sensu carent, magnum consensum habent; nisi quod in corpore sensibili accedat spiritus. Nam pupilla oculi speculo sive aquis æquiparatur; et simili natura imagines lucis et rerum visibilium excipit et reddit. Organum autem auditus obici intra locum cavernosum[2] conforme est, a quo vox et sonus optime resultat. Attractiones autem rerum inanimatarum, et rursus horrores sive fugæ (eas dico, quæ ex proprietate fiunt) in animalibus, olfactui atque odoribus gratis et odiosis conveniunt. Tactus autem ratio et gustus, omnem quæ in corporibus inanimatis accidere possit aut violentiam aut contra insinuationem almam et amicam, ac universas earundem passionum figuras, veluti vates aut interpres exprimit. Nam compressiones, extensiones, erosiones, separationes, et similia, in corporibus mor-

[1] The following sentence is added in the MS.: "Eadem est et spongiarum ratio. Quin et metalla dum per calorem liquefiant, majorem partium æqualitatem deposita naturali congelatione obtinent." — *J. S.*

[2] *loco cavernoso* in MS.

tuis in processu latent, nec nisi post effectum manifestum percipiuntur. In animalibus autem cum sensu doloris secundum diversa genera aut characteres violentiæ peraguntur, permeante per omnia spiritu. Atque ab hoc principio deducitur cognitio, num forte alicui animantium adsit alius quispiam sensus, præter eos qui notantur; et quot et quales sensus in universo animantium genere esse possint. Ex passionibus enim materiæ rite distinctis sequetur numerus sensuum, si modo organa competant et accedat spiritus.

VIII.

De Motu Violento, quod sit fuga et discursatio partium rei propter pressuram, licet minime visibilis.

Motus violentus (quem vocant) per quem missilia, ut lapides, sagittæ, globi ferrei, et similia per aërem volant, fere omnium motuum est vulgatissimus. Atque in hujus tamen observatione et inquisitione miram et supinam negligentiam hominum notare licet. Neque parvo detrimento in motus istius natura et potestate investiganda offenditur; cum ad infinita sit utilis, et tormentis, machinis, et universæ rei mechanicæ, sit instar animæ et vitæ. Plurimi autem se perfunctos inquisitione putant, si motum illum violentum esse pronuntient, et a naturali distinguant. Atque is sane est Aristotelis et scholæ ejus mos proprius et disciplina, curare ut habeant homines quod pronuntient, non quod sentiant; et docere quomodo aliquis affirmando aut negando se expedire, non cogitando se explicare et sibi satisfacere possit. Alii paulo attentius, arrepto illo posito duo corpora in uno loco esse non posse, restare

aiunt ut quod fortius sit impellat, debilius cedat; eam cessionem sive fugam, si minor adhibeatur vis, non ultra durare quam prima impulsio continuetur; ut in protrusione; si autem major, etiam remoto corpore impellente ad tempus vigere, donec sensim remittatur; ut in jactu. Atque hi rursus, alio ejusdem scholæ more inveterato, primordia rei captant, de processu et exitu non solliciti; tanquam prima quæque cætera trahant; quo fit ut immatura quadam impatientia contemplationem abrumpant. Nam ad id quod corpora sub ipsum ictum cedant, aliquid afferunt; sed postquam corpus impellens jam remotum sit, adeo ut necessitas illa confusionis corporum jam plane cessaverit, cur postea motus continuetur, nihil dicunt, nec seipsi satis capiunt. Alii autem magis diligentes[1] et in inquisitione perseverantes, cum vim aëris in ventis et similibus quæ vel arbores et turres dejicere possit animadvertissent, opinati sunt eam vim quæ hujusmodi missilia post primam impulsionem deducat et comitetur aëri debere attribui, pone corpus quod movetur collecto et ingruenti; cujus impetu corpus tanquam navis in gurgite aquarum vehatur. Atque hi certe rem non deserunt, atque contemplationem ad exitum perducunt; sed tamen a veritate aberrant. Res autem vere in hunc modum se habet. Præcipuus motus partibus

[1] See Fracastorius, *De Sympath. et Antipath.* c. 4., to whom Bacon refers in the *Nov. Org.* [II. 36., Vol. I. p. 447.] That the medium through which a body is projected is the cause of its continuing to move after it has parted from that which projects it, had however been taught by Aristotle. See the *Physics*, viii. 10.; a passage which, though the theory of projectiles contained in it is altogether false, yet shows that Aristotle had formed a distinct though incomplete conception of the propagation of motion through any medium. Aristotle's view seems not to have been rightly understood by his commentators. See Brandis's *Scholia*, p. 451., at bottom; and compare Cardan, *De Subtil.* ii., and Vanini, *Dialogi*, xi.

ipsius corporis, quod volat, inesse videtur: qui, cum visu ob nimiam subtilitatem non percipiatur, homines non satis attendentes, sed levi observatione rem transmittentes, latet. Accuratius autem scrutanti manifeste constat, corpora quæ duriora sunt pressionis esse impatientissima, et ejusdem veluti sensum acutissimum habere; adeo ut quam minimum a naturali positione depulsa, magna pernicitate nitantur ut liberentur et in pristinum statum restituantur. Quod ut fiat, partes singulæ, facto principio a parte pulsata, se invicem non secus ac vis externa protrudunt ac urgent;[1] et fit continua et intensissima (licet minime visibilis) partium trepidatio et commotio. Atque hoc videmus fieri in exemplo vitri, sacchari, et hujusmodi rerum fragilium; quæ si mucrone aut ferro acuto secentur aut dividantur, protinus in aliis partibus, a tractu mucronis remotis, quasi in instanti disrumpuntur. Quod evidenter demonstrat communicationem motus pressuræ in partes succedentes. Qui motus cum per omnia moliatur et ubique tentet, ea parte confractionem inducit qua ex præcedente corporis dispositione minus fortis erat compactio. Neque tamen ipse motus, quando per omnia turbat et percurrit, sub aspectum venit, donec aperta fiat effractio sive continuitatis solutio. Rursus videmus, si forte filum ferreum, aut bacillum, aut durior pars calami (vel hujusmodi corpora, quæ flexibilia quidem sunt, non absque aliqua renitentia) inter pollicem et indicem per extrema sua curventur et stringantur, ea statim prosilire. Cujus motus causa manifeste deprehenditur non esse in extremis corporis partibus, quæ digitis stringuntur, sed in medio, quod vim patitur; ad cujus relevationem motus ille se expedit. In

[1] *vigent* in Gruter's edition. — *J. S.*

hoc autem exemplo plane liquet, causam illam motus quam adducunt de impulsione aëris excludi. Neque enim ulla fit percussio, quæ aërem immittat. Atque hoc etiam levi illo experimento evincitur, cum pruni nucleum recentem et lubricum premimus, digitosque paulatim adducimus, atque hac ratione emittimus. Nam et in hoc quoque exemplo compressio illa vice percussionis est. Evidentissimus autem hujusce motus effectus cernitur, in perpetuis conversionibus sive rotationibus corporum missilium dum volant. Siquidem ea procedunt utique, sed progressum suum faciunt in lineis spiralibus, hoc est procedendo et rotando. Atque certe is *motus spiralis*, cum tam sit rapidus, et nihilominus tam expeditus, et rebus quodammodo familiaris, nobis dubitationem movit, num forte ex altiore principio non penderet. Sed existimamus non aliam causam huic rei subesse, quam eandem quam nunc tractamus. Namque pressura corporis affatim motum in partibus sive minutiis ejus excitat, ut se quacunque via expediant et liberent. Itaque corpus non solum in linea recta agitur et provolat, sed undequaque experitur, atque ideo se rotat ; utroque enim modo ad se laxandum nonnihil proficit. Atque in rebus solidis subtile quiddam et abditum ; in mollibus evidens et quasi palpabile est. Nam ut cera vel plumbum, et hujusmodi mollia, malleo percussa cedunt, non tantum in directum, sed et in latera undequaque : eodem modo et corpora dura sive renitentia fugiunt et in recta linea et in circuitu. Cessio enim corporalis in mollibus, et localis in duris, ratione conveniunt ; atque in corporis mollis efformatione, corporis duri passio, cum fugit et volat, optime conspicitur. Interim nemo existimet nos præter motum istum (qui caput rei est) non etiam aliquas

partes aëri devehenti tribuere, qui motum principalem adjuvare, impedire, flectere, regere possit. Nam et ejus rei potestas est non parva. Atque hæc motus violenti sive mechanici (qui adhuc latuit) explicatio, veluti fons quidam practicæ est.

IX.

De causa motus in tormentis igneis, quod ex parte tantum, nec ea potiore, inquisita sit.

TORMENTORUM igneorum causa, et motus tam potentis et nobilis explicatio, manca est, et ex parte potiore deficit. Aiunt enim pulverem tormentarium, postquam in flammam conversus sit et extenuatus, se dilatare et majus spatium occupare: unde sequi, — ne duo corpora in uno loco sint, aut dimensionum penetratio fiat, aut forma elementi destruatur, aut situs partium præter naturam totius sit (hæc enim dicuntur), — corporis quod obstat expulsionem vel effractionem. Neque nihil est, quod dicunt. Nam et iste appetitus, et materiæ passio, et[1] hujusmodi motus pars aliqua. Sed nihilominus in hoc peccant, quod ad necessitatem istam corporis dilatandi rem præpropera cogitatione deducunt, neque quod natura prius est distincte considerant. Nam ut corpus pulveris, postquam in flammam mutatus est, majorem locum occupet, necessitatem sane habet; ut autem corpus pulveris inflammetur, idque tam rapide, id simili necessitate non constringitur; sed ex præcedente motuum conflictu et comparatione pendet. Nam dubium non est, quin corpus illud solidum et grave, quod per hujusmodi motum extruditur vel removetur, antequam cedat, sedulo obnitatur; et

[1] M. Bouillet reads *est*.

si forte robustius sit, victoria potiatur; id est, ut non flamma globum expellat, sed globus flammam suffocet. Itaque si loco pulveris tormentarii, sulphurem vel caphuram vel similia accipias, quæ flammam et ipsa cito corripiunt, et (quia corporum compactio inflammationi impedimento est) ea in grana pulveris, admista cineris juniperi vel alicujus ligni maxime combustilis aliqua portione, efformes; tamen (si nitrum absit) motus iste rapidus et potens non sequitur: sed motus ad inflammationem a mole corporis renitentis impeditur et constringitur, nec se explicat aut ad effectum pertingit. Rei autem veritas sic se habet. Motum istum, de quo quæritur, geminatum et compositum reperias. Nam præter motum inflammationis, qui in sulphurea pulveris parte maxime viget, subest alius magis fortis et violentus. Is fit a spiritu crudo et aqueo, qui ex nitro maxime, et nonnihil a carbone salicis concipitur, qui et ipse expanditur certe (ut vapores subdito calore solent), sed una etiam (quod caput rei est) impetu rapidissimo a calore et inflammatione fugit et erumpit, atque per hoc etiam inflammationi vias relaxat et aperit. Hujusce motus rudimenta et in crepitationibus aridorum foliorum lauri vel hederæ cernimus, cum in ignem mittuntur; et magis etiam in sale, qui ad rei inquisitæ naturam propius accedit. Simile etiam quiddam et in sevo candelarum madido et in flatulentis ligni viridis flammis sæpe videmus. Maxime autem eminet iste motus in argento vivo, quod corpus maxime crudum, et instar aquæ mineralis est; cujus vires (si ab igne vexetur, et ab exitu prohibeatur) non multo pulveris tormentarii viribus inferiores sunt. Itaque hoc exemplo monendi homines sunt et rogandi, ne in causarum inquisitione unum aliquod arripiant, et facile

pronuntient; sed circumspiciant, et contemplationes suas fortius et altius figant.

X.

De dissimilitudine cœlestium et sublunarium quoad æternitatem et mutabilitatem; quod non sit verificata.

Quod receptum est, universitatem naturæ veluti per globos recte dividi et distingui; ut alia sit ratio cœlestium, alia sublunarium; id non absque causa introductum videtur, si in hac opinione modus adhibeatur. Dubium enim non est, quin regiones sub orbe lunari positæ et supra, una cum corporibus quæ sub eisdem spatiis continentur, multis et magnis rebus differant. Neque tamen hoc certius est quam illud, corporibus utriusque globi inesse communes inclinationes, passiones, et motus. Itaque unitatem naturæ sequi debemus, et ista distinguere potius quam discerpere, nec contemplationem frangere. Sed quod ulterius receptum est, — cœlestia mutationes non subire; sublunaria vero aut elementaria, quæ vocant, iisdem obnoxia esse; et materiam horum instar meretricis esse, novas formas perpetuo appetentem; illorum autem instar matronæ, stabili et intemerato connubio gaudentem; — popularis opinio videtur esse, et infirma, et ex apparentia et superstitione orta. Videtur autem nobis hæc sententia ex utraque parte labilis et sine fundamento. Nam neque cœlo ea competit æternitas quam fingunt, nec rursus terræ ea mutabilitas. Nam, quod ad cœlum attinet, non ea nitendum est ratione, mutationes ibidem non fieri, quia sub aspectum non veniunt. Aspectum enim frustrat et corporis subtilitas et loci distantia. Nam variæ inveniuntur aëris mutationes, ut in æstu,

frigore, odoribus, sonis, manifestum est, quæ sub visum non cadunt. Neque rursus (credo), si oculus in circulo lunæ positus esset, a tanto intervallo quæ hic apud nos fiunt, et qui in superficie terræ obveniunt motus et mutationes machinarum, animalium, plantarum, et hujusmodi, (quæ pusillæ alicujus festucæ dimensionem, ob distantiam, non æquant,) cernere posset. In corporibus autem quæ tantæ molis et magnitudinis sunt, ut ob dimensionum suarum amplitudinem spatia distantiarum vincere atque ad aspectum pervenire possunt,[1] mutationes in regionibus cœlestibus fieri, ex cometis quibusdam satis liquet; iis dico, qui[2] certam et constantem configurationem cum stellis fixis servarunt; qualis fuit illa, quæ[3] in Cassiopea nostra ætate apparuit.[4] Quod autem ad terram attinet; postquam ad interiora ejus, relicta ea quæ in superficie et partibus proximis invenitur incrustatione et mixtura, penetratum est, videtur et ibi quoque similis ei quæ in cœlo supponitur perpetuitas existere. Proculdubio enim est, si in profundo terra pateretur mutationes, consequentiam earum mutationum, etiam in nostra regione, quam calcamus, majores casus fuisse parituram quam fieri videmus. Sane terræ motus plerique, et eruptiones aquarum, vel eructationes ignium, non ex profundo admodum, sed prope, insurgunt; cum parvum aliquod

[1] M. Bouillet reads *possint*.

[2] *quæ* in MS.

[3] So in the original. It should apparently be *ille, qui*. — *J. S.*

[4] The star which appeared in Ophiuchus in 1604 is generally mentioned by Galileo in conjunction with the one in Cassiopeia (which appeared in 1572), as evidence against the doctrine of the immutability of the heavens. It seems, therefore, that the *Cogitationes* were written before or not long after 1604, especially as in the *Descriptio Globi Intellectualis* the two stars are mentioned together. But a similar argument would show that they were written before or soon after 1600, as the new star in Cygnus is not mentioned. [On this last point see the preface p. 201. — *J. S.*]

spatium in superficie occupent. Quanto enim latiorem regionem et tractum hujusmodi accidentia in facie terræ occupant, tanto magis radices sive origines eorum ad viscera terræ penetrare putandum est. Itaque majores terræ motus (majores, inquam, ambitu, non violentia) qui rarius eveniunt, recte cometis ejus generis de quo diximus æquiparari possunt; qui et ipsi infrequentes sunt; ut illud maneat quod initio diximus, inter cœlum et terram, quatenus ad constantiam et mutationem, non multum interesse. Si quem autem æquabilitas et certitudo motus in corporibus cœlestibus apparens movet, veluti æternitatis comes individuus; præsto est oceanus, qui in æstu suo haud multo minorem constantiam ostendat.[1] Postremo, si quis adhuc instet, negari tamen non posse quin in ipsa superficie orbis terrarum et partibus proximis infinitæ fiant mutationes, in cœlo non item; huic ita responsum volumus: nec nos hæc per omnia æquare; et tamen si regiones (quas vocant) *superiorem* et *mediam* aëris pro superficie aut interiore tunica cœli accipiamus, quemadmodum spatium istud apud nos, quo animalia, plantæ, et mineralia continentur, pro superficie vel exteriore tunica terræ accipimus, et ibi quoque varias et multiformes generationes et mutationes inveniri.[2] Itaque tumultus fere omnis, et conflictus, et perturbatio, in confiniis tantum cœli et terræ locum habere videtur. Ut in rebus civilibus fit; in quibus illud frequenter usu venit, ut duorum regnorum fines continuis incursionibus et violentiis infestentur, dum interiores utriusque regni provinciæ secura pace atque alta quiete fruuntur. Nemo autem, si recte attenderit, religionem hic opponat. Nam ethnica jactantia solummodo prærogativa

[1] *ostentat* in MS. [2] *invenire* in MS.

ista cœlum materiatum donavit, ut sit incorruptibile. Scripturæ autem Sacræ æternitatem et corruptionem cœlo et terræ ex æquo, licet gloriam et venerationem disparem, attribuunt. Nam si legatur, *solem et lunam fideles et æternos in cœlo testes esse;* legitur etiam, *generationes migrare, terram autem in æternum manere.* Quod autem utrumque transitorium sit, uno oraculo continetur, nempe *cœlum et terram pertransire, verbum autem Domini non pertransire.* Neque hæc nos novi placiti studio diximus, sed quod ista rerum et regionum conficta divortia et discrimina, ultra quam veritas patitur, magno impedimento ad veram philosophiam et naturæ contemplationem fore, haud ignari sed exemplo edocti, providemus.

DE

FLUXU ET REFLUXU MARIS.

PREFACE

TO THE

DE FLUXU ET REFLUXU MARIS.

BY ROBERT LESLIE ELLIS.

It was a natural result of the progress of maritime discovery in the sixteenth century, that much was thought and written on the subject of the tides. The reports continually brought home touching the ebb and flow of the sea on far distant shores, not only excited curiosity, but also showed how little the philosophers of antiquity had known of the phenomena which they attempted to explain. Men who dwelt on the shores of an inland sea, and whose range of observation scarcely extended beyond the Pillars of Hercules, were in truth not likely to recognise any of the general laws by which these phenomena are governed. Their authority accordingly in this matter was of necessity set aside; and a number of hypotheses were proposed in order to explain the newly discovered facts. Of these speculations an interesting account is given in the twenty-eighth book of the *Pancosmia* of Patricius. It is not, however, complete; no mention being made of

the hypothesis of Cæsalpinus, which is in itself a curious one, and which clearly suggested to Galileo his own explanation of the cause of the tides. Otto Casmann, the preface to whose *Problemata Marina* is dated in 1596, gives a good deal of information on the same subject, some of which however seems to be simply copied from Patricius; but he mentions Cæsalpinus, whom, as I have said, Patricius omits. Patricius, it may be remarked, is a scrupulously orthodox philosopher, and dedicates his work to Gregory XIV. with many expressions of reverence and submission.

It is perhaps on this account that he has said nothing of Cæsalpinus, whose works were "improbatæ lectionis" and who seeks to explain the tides, and also certain astronomical phenomena, by denying the orthodox doctrine of the earth's immobility.

The earliest modern writer whom Patricius mentions is Frederick Chrysogonus, whose work on the tides must have been published in 1527. To his account of the phenomena little, according to Patricius, was added by subsequent writers; nor are his statements contradicted by the reports of seafaring men, who however mention certain matters of detail which he had omitted. Of seamen Patricius particularly mentions Peter of Medina and Nicolaus Sagrus, the latter with especial commendation. From Sagrus (but probably through Patricius) Bacon derived some of the statements of the following tract; those, namely, which relate to the progress of the tide-wave from the Straits of Gibraltar to Gravelines. On the day of new moon, according to Sagrus, there is high water along the coast from Tarifa to Rota at an hour and a half after midnight. After

mentioning several intermediate places, he says that along the coast of Normandy as far as Calais and Nieuport there is high water at nine, and after a not very distinct statement as to the time of high water in the middle of the channel, goes on to state that from Calais to Gravelines the water is high off shore (in derotâ) at an hour and a half after midnight, that is at the same time as at Rota, and at Zealand at the same time as on the coast of Portugal. These statements are scarcely sufficiently accurate to make it worth while to compare them with modern observations; but it is necessary to remark that Sagrus, though he mentions it as a remarkable circumstance that the time of high water should be the same at Gravelines and at Rota, does not mean to assert that there is any discontinuity in the progress of the tide along the shores of France and the Netherlands. The tide gets progressively later and later until we come to a place where there is high water about one in the afternoon, and therefore also high water about half-past one after the succeeding midnight. In order to compare Gravelines and Rota, he takes (but without mentioning that he does so) two different tide-waves, — the statement with reference to Gravelines appearing to relate to a later wave than the other. Bacon however does not appear to have understood this; and consequently, after saying that the hour of high water becomes later and later from the Straits of Gibraltar to the coast of Normandy, proceeds thus: — "Hucusque ordinatim; ad Gravelingam vero, verso prorsus ordine, idque magno saltu, quasi ad eandem horam cum ostio freti Herculei." This notion of a reversal of the order of the tides as we proceed along the French and Dutch coast is not justified either by

Sagrus's statements or by the phenomena to which they relate.[1]

Sagrus is probably the first writer who remarks that the time of high water is not always the same as that of slack water. "Et illud adnotat Sagrus," says Patricius, "non minus mirum" (he has been speaking of the coincidence as to the time of high water between the Dutch and Portuguese coasts) "si a Selandiâ quis ad caput Angliæ Dobla [Dover?] naviget, mare plenum erit a medinoctio tertiâ quidem horâ, sed eodem itinere, fluxus aquæ obvius fiet per horas duas cum dimidiâ donec flaccescat, quod nautæ dicunt aquam fieri stancam." Patricius rightly compares this with the phenomenon observed at Venice, namely that when the water has already sunk half a foot at the entrance of the harbour it is still rising in the harbour itself.

With respect to theories of the cause of the tides, it may be observed that a connexion of some kind or other between the tides and the moon has at all times been popularly recognised. But the conception which was formed as to the nature of this connexion long continued vague and indefinite; and in Bacon's time those who speculated on the subject were disposed to reject it altogether. One theory, that of Telesius and Patricius, compares the sea to the water in a caldron; that is to say it rises and tends to boil over when its natural heat is called forth under the influence of the sun, moon, and stars, and then after a while subsides. But why should this alternate rise and fall have a definite period of six hours? Patricius calmly an-

[1] I have given Sagrus's statements *in extenso* in a note on the passage in the text. He seems to have forgotten that Nieuport is farther from Calais than Gravelines.

swers, "nimirum quia omnis motus fit in tempore," and that there is no better reason for asking the question than for asking why certain other motions have periods of seven or fourteen days, of six months or twelve.

Another theory, which was propounded by Sfondratus, in a tract published in 1590, and entitled *Causa Æstûs Maris*, explains the reciprocating motion of ebb and flow [as owing] to the effect produced by the continent of America. The water under the influence of the sun moves in accordance with the motion of the heavens from east to west. But it is reflected and made to regurgitate eastward by impinging on the coast of America, which was supposed to extend indefinitely southward (Cape Horn was not discovered until [1615]) and which permits only a portion of it to pass through the Straits of Magellan. Between this theory, of which Patricius speaks contemptuously and without mentioning the name of its author, and that which J. C. Scaliger had put forth in the *Exercitationes adversum Cardanum*, 52., there is no essential difference, though Scaliger ascribes the general westward motion of the ocean to its sympathy with the moon. But in both theories the change of direction of the motion is ascribed to the action of the coast of America; and both were doubtless suggested by the current which flows from east to west through the Straits of Magellan.

Bacon himself, as we perceive from the following tract, was inclined to adopt the same view. He compares the Straits of Dover with those of Magellan, and conceives that the German Ocean exhibits on a small scale the same phenomena of a stream tending in one

direction, and compelled to regurgitate in the opposite one by the obstacles which it meets with, as the great Atlantic. This at least appears to be the import of the expressions of which he makes use. That the period of the revolution of the waters round the earth is greater than twenty-four hours, appeared to Bacon to be in entire accordance with the retardation of the diurnal motion of the planets. All the inferior orbs lag behind the starry heaven, and that of the moon most of all; wherefore the moon's diurnal period is more nearly the same as that of the waters than any other.

In these views there is an absolute confusion between the bodily motion of water as in a current, and the propagation of an undulation; a confusion not unnatural, seeing that to conceive the motion of an undulation apart from that of the matter of which it is composed is by no means easy. Scaliger however might have learned from Cardan, notwithstanding the arrogance with which he treats him, to distinguish between them. For Cardan, after saying that high water follows the moon, inquires why the motion of the flood current is so much slower than the moon's. He answers: "Causa est, quod non tota aqua, nec una pars lunam sequitur, sed proximæ in proximas transferuntur, velut si quis carnem comprimens tumorem elevet, caro quidem parum loco movebitur, celerrimè tamen tumor per totum crus transferetur." [1]

It became necessary, when the flood current was confounded with the motion of the tide wave, to assign a cause for the reciprocating motion of ebb and

[1] De Subtilit. ii. p. 408.

flow; and this cause was sought for in the configuration of land and sea.

It seems as if Aristotle, if he had developed any theory of the tides, would have had recourse to some similar explanation. Thus Strabo says, (I quote from Xylander's translation,) "Jam Aristotelem Posidonius ait æstuum marinorum qui fiunt in Hispaniâ causas non recte ascribere litori et Mauritaniæ" (by litori is probably meant the coast of Spain itself), "dicentem mare ideo reciprocare, quia extrema terrarum sublimia sint et aspera, quæ et fluctum duriter excipiant et in Hispaniam repercutiant, cum pleraque litora sint humilia et arenæ tumulis constent."[1] With this passage is to be compared what Aristotle says in the commencement of the second book of the *Meteorologics*, from which it appears to have been his opinion that the seas within the Pillars of Hercules flow continually outwards in consequence of differences of level, and that where the sea is girt in by straits its motion becomes visible in the form of a reciprocating libration: διὰ τὸ ταλαντεύεσθαι δεῦρο κἀκεῖσε. This obscure expression is taken to relate to the tides, and probably does so. It suggested to Cæsalpinus his theory of their cause. At least he quotes it, and dilates on its meaning; and when the ebb and flow of the sea is conceived of as a libration, it is easily inferred that this libration ought to be ascribed not directly to the fluid itself but to that on which it rests. And this notion of the libration of the earth connected itself with his views of astronomy. For in order to

[1] Strabo, iii. p. 153. It is worth remarking that this passage is quoted by Ideler in his edition of the *Meteorologics*, i. p. 501., in a way which makes it quite unintelligible, some words having been accidentally omitted.

get rid of the necessity of supposing the existence of a ninth and tenth heaven, — the former to explain the precession of the equinoxes, and the latter the imaginary phenomenon of their trepidation, — he ascribed the motion by which these phenomena are produced to the earth itself. The cause of this motion he sought in the action of the ambient air on the earth's surface. To explain trepidation, the earth's motion was supposed to be in some measure libratory and irregular; and by being so it produced the tides.[1]

From the theory of Cæsalpinus we pass naturally to that of Galileo, seeing that in both the tides are explained by the unequal motion of the earth. Galileo's theory was first propounded in a letter to Cardinal Orsino, dated 1616. He remarks that the libratory motion "che alcuno ha attribuito alla Terra," (alluding of course to Cæsalpinus,) is in several respects not such as to save the phenomena, and maintains that the true cause is to be sought in the combination of the earth's motion in its orbit with its rotation on its own axis. In consequence of this combination, the velocity of any point of the earth's surface varies, going through its different values in the space of twenty-four hours. The waters of the sea, not accommodating themselves to this varying velocity, ebb and flow at any place as their velocity is less or greater than that of their bed. The boldness of the assertions by which Galileo supports this theory is remarkable: thus he affirms that the ebb and flow is always from west to east, and vice versâ; and that the notion that, speaking generally, the interval between high water and low is six hours "è stata un' ingannevole opinione la quale ha poi fatto

[1] Quæstiones Peripat. iii. 4. and 5.

favoleggiare gli scrittori con molte vane fantasie." No refutation of a theory which altogether misrepresents the facts which it proposes to explain could ever have been needed; but the advance of mechanical science has long since made it easy to show that no reciprocating motion of the waters of the sea could be produced in the manner described by Galileo.

Bacon does not mention Galileo's theory in the present tract, which was therefore probably written before or not long after 1616. But in the *Novum Organum* [II. 46.] it is mentioned and condemned; one ground of censure being that it proceeds on the untenable hypothesis of the earth's motion, and the other that the phenomena are misrepresented.

Bacon, both in this tract and in the *Novum Organum*, ascribes the tides in the Atlantic to a derivative motion of the waters, caused by the obstacles which the form of the continents of the old and new worlds oppose to its general westerly movement. It is thus that he meets the objection which would arise from the circumstance that there is high water at the same time on corresponding points of the shores of Europe and America. This notion of a derivative tide is absolutely necessary in the detailed explanation of the phenomena, and I am not aware that any one had previously suggested it, at least in the distinct form in which Bacon puts it. He admits that, if the tides of the Pacific synchronise with those of the Atlantic, his theory that the tides depend on a progressive motion of the ocean must be given [up]. If it be high water on the shores of Peru and China at the same hours as on those of Florida and Europe, there are no shores left on which there can then be low water. For the important ob-

servation that the hours of high water correspond, speaking roughly, on the European and American coasts, Bacon quotes in the *De Fluxu et Refluxu Maris* no authority; but in the *Novum Organum* he ascribes it to Acosta and others. But it is very remarkable that Acosta does not say what Bacon makes him say, namely that the times of high water are the same on the coast of Florida and that of Europe, and that he does say what Bacon admits would be fatal to his theory, namely that there is high water at the same time in the Atlantic and Pacific oceans. In his *Natural History of the Indies*, iii. 14., he speaks of the tides, and of the two theories by which they had been explained. There are some, he says, who affirm that the ebb and flow of the sea resembles a caldron of water moved to and fro, the water rising on one side when it falls on the other, and reciprocally; while others liken it to the boiling over of a pot, which rises and falls on all sides at once. The second view is in his judgment the true one. He says that he had inquired from a certain pilot, Hernandez Lamero,[1] who had sailed through the Straits of Magellan about the year 1579, how he had found the tides there, and particularly if the tide of the South Sea or Pacific flowed when that of the North Sea or Atlantic ebbed, and vice versâ. Lamero made answer that it was not so, that both tides ebb and flow together, and that they meet about seventy leagues from the Atlantic and thirty from the South Sea. With this statement Acosta is altogether satisfied; and so far from trying to compare the time of high water on the opposite shores of the Atlantic, he remarks that but for the Straits of Magellan it would be impossible

[1] See Acosta, iii. 11.

to determine experimentally which of the two theories he has mentioned is the true one; as only angels could make observations on both sides of the ocean at once, the eyes of men not reaching far enough to do so, and the distance being too great to be crossed by man in the time of a single tide.

DE FLUXU ET REFLUXU MARIS.

Contemplatio de causis fluxus et refluxus maris, ab antiquis tentata et deinde omissa, junioribus repetita, et tamen varietate opinionum magis labefactata quam discussa, vulgo levi conjectura refertur ad lunam, ob consensum nonnullum motus ejusdem cum motu lunæ. Attamen diligentius perscrutanti vestigia quædam veritatis se ostendunt, quæ ad certiora deducere possint. Itaque ne confusius agatur, primo distinguendi sunt motus maris, qui licet satis inconsiderate multiplicentur a nonnullis, inveniuntur revera tantum quinque; quorum unus tanquam anomalus est, reliqui constantes. Primus ponatur motus ille vagus et varius (quos appellant) *currentium*. Secundus motus magnus oceani sexhorarius, per quem aquæ ad littora accedunt et recedunt alternatim bis in die, non exacte, sed cum differentia tali quæ periodum constituat menstruam. Tertius motus ipse menstruus, qui nil aliud est quam restitutio motus (ejus quem diximus) diurni ad eadem tempora. Quartus motus semimenstruus, per quem fluxus habent incrementa in noviluniis et pleniluniis, magis quam in dimidiis. Quintus motus semestris, per quem fluxus habent incrementa auctiora et insignia in æquinoctiis. Atque de secundo illo motu magno oceani sexhorario sive diurno, nobis in

præsentia sermo est præcipue et ex intentione; de reliquis solummodo in transitu, et quatenus faciant ad hujusce motus explicationem. Primo igitur, quod ad motum currentium attinet, dubium non est quin pro eo ac aquæ vel ab angustiis premuntur, vel a liberis spatiis laxantur, vel in magis declivia festinant ac veluti effunduntur, vel in eminentiora incurrunt ac inscendunt, vel fundo labuntur æquabili, vel fundi sulcis et inæqualitatibus perturbantur, vel in alios currentes incidunt atque cum illis se miscent et compatiuntur, vel etiam a ventis agitantur, præsertim anniversariis sive statariis, qui sub anni certas tempestates redeunt, aquas ex his et similibus causis impetus et gurgites suos variare, tam consecutione ipsius motus atque latione quam velocitate sive mensura motus, atque inde constituere eos quos vocant *currentes*. Itaque in maribus, tum profunditas fossæ sive canalis atque interpositæ voragines et rupes submarinæ, tum curvitates littorum, et terrarum prominentiæ, sinus, fauces, insulæ multis modis locatæ, et similia, plurima possunt, atque agunt prorsus aquas earumque meatus et gurgites in omnes partes, et versus orientem et versus occidentem, austrum versus similiter et septentriones, atque quaquaversum, prout obices illi aut spatia libera et declivia sita sint et invicem configurentur. Segregetur igitur motus iste aquarum particularis et quasi fortuitus, ne forte ille in inquisitione quam prosequimur obturbet. Neminem enim par est constituere et fundare abnegationem eorum quæ mox dicentur de motibus oceani naturalibus et catholicis, opponendo motum istum currentium, veluti cum thesibus illis minime convenientem. Sunt enim currentes meræ compressiones aquarum, aut liberationes a compres-

sione: suntque, ut diximus, particulares et respectivi, prout locantur aquæ et terræ, aut etiam incumbunt venti. Atque hoc quod diximus eo magis memoria tenendum est atque diligenter advertendum, quia motus ille universalis oceani, de quo nunc agitur, adeo mitis est et mollis, ut a compulsionibus currentium omnino dometur et in ordinem redigatur, cedatque, et ad eorum violentiam agatur et regatur. Id autem ita se habere ex eo perspicuum est vel maxime, quod motus simplex fluxus et refluxus maris in pelagi medio, præsertim per maria lata et exporrecta, non sentiatur, sed ad littora tantum. Itaque nihil mirum si sub currentibus (utpote viribus inferior) lateat et quasi destruatur, nisi quod ille ipse motus, ubi currentes secundi fuerint, eorum impetum nonnihil juvet atque incitet; contra ubi adversi, modicum frenet. Misso igitur motu currentium, pergendum est ad motus illos quatuor constantes, *sexhorarium*, *menstruum*, *semimenstruum*, et *semestrem*; quorum solus sexhorarius videtur fluxus maris agere et ciere, menstruus vero videtur tantummodo motum illum determinare et restituere, semimenstruus autem et semestris eundem augere et intendere. Etenim fluxus et refluxus aquarum qui littora maris ad certa spatia inundat et destituit, et horis variis variat et vi ac copia aquarum, unde reliqui illi tres motus se dant conspiciendos. Itaque de illo ipso motu fluxus et refluxus sigillatim ac proprie (ut instituimus) videndum. Atque primo illud dari prorsus necesse est: motum hunc de quo inquirimus unum ex duobus istis esse, vel motum sublationis et demissionis aquarum, vel motum progressus. Motum autem sublationis et demissionis talem esse intelligimus, qualis invenitur in aqua bullienti, quæ in calda-

rio attollitur et rursum residet. At motum progressus talem, qualis invenitur in aqua vecta in pelvi, quæ unum latus deserit, cum ad latus oppositum advolvitur. Quod vero motus iste neutiquam sit primi generis, occurrit illud inprimis, quod in diversis mundi partibus variant æstus secundum tempora; ut fiant in aliquibus locis fluxus et augmenta aquarum, cum alibi sint ad eas horas refluxus et decrementa. Debuerant autem aquæ, si illæ non progrederentur de loco in locum sed ex profundo ebullirent, ubique[1] simul se attollere, atque rursus simul se recipere. Videmus enim duos illos alios motus, semestrem et semimenstruum, per universum orbem terrarum simul perfungi atque operari. Fluxus enim sub æquinoctiis ubique augentur; non in aliis partibus sub æquinoctiis, in aliis sub tropicis; atque similis est ratio motus semimenstrui. Ubique enim terrarum invalescunt aquæ in noviluniis, nullibi in dimidiis. Itaque videntur revera aquæ in duobus illis motibus plane attolli et demitti, et veluti pati apogæum et perigæum, quemadmodum cœlestia. Atque in fluxu et refluxu maris, de quo sermo est, contra fit: quod motus in progressu certissimum signum est. Præterea si fluxus aquarum ponatur esse sublatio, attendendum paulo diligentius quomodo ista sublatio fieri possit. Aut enim fiet tumor ab aucto quanto aquarum, aut ab extensione sive rarefactione aquarum in eodem quanto, aut per sublationem simplicem in eodem quanto atque eodem corpore. Atque tertium illud prorsus abjiciendum. Si enim aqua, qualis est, attollatur, ex hoc relinquatur necessario inane inter terram atque ima aquæ, cum non sit corpus quod succedat. Quod si sit nova moles aquæ,

[1] *ibique* in the original. — *J. S.*

necesse est eam emanare atque scaturire e terra. Sin vero sit extensio tantum, id fiet vel per solutionem in magis rarum, vel appetitum appropinquandi ad aliud corpus quod aquas veluti evocet et attrahat et in sublimius tollat. Atque certe ista aquarum sive ebullitio, sive rarefactio, sive conspiratio cum alio quopiam corpore ex superioribus, non incredibilis videri possit in mediocri quantitate, atque adhibito etiam bono temporis spatio, in quo hujusmodi tumores sive augmenta se colligere et cumulare possint. Itaque excessus ille aquarum qui inter æstum ordinarium atque æstum illum largiorem semimenstruum aut etiam illum alterum profusissimum semestrem notari possit, cum nec mole excessus inter fluxum et refluxum æquiparetur atque habeat etiam bene magnum intervallum temporis ad incrementa illa sensim facienda, nihil habeat alienum a ratione. Ut vero tanta erumpat moles aquarum, quæ excessum illum qui invenitur inter ipsum fluxum et refluxum salvet; atque hoc fiat tanta celeritate, videlicet bis in die, ac si terra, secundum vanitatem illam Apollonii,[1] respiraret, atque aquas per singulas sex horas efflaret, ac deinde absorberet; incommodum maximum. Neque moveatur quispiam levi experimento, quod putei nonnulli in aliquibus locis memorentur consensum habere cum fluxu et refluxu maris; unde suspicari quis possit, aquas in cavis terræ conclusas similiter ebullire; in quo casu tumor ille ad motum progressivum aquarum referri commode non possit. Facilis enim est responsio, posse fluxum maris accessione sua multa loca cava ac laxa terræ obturare atque opplere, atque aquas subterraneas vertere, etiam aërem conclusum reverberare, qui serie continuata hujusmodi

[1] Philos. Vit. Apoll. Tyan. [See *Sylva Sylvarum*, *supra* p. 117. — *J. S.*]

puteorum aquas trudendo attollere possit. Itaque hoc in omnibus puteis minime fit, nec in multis adeo; quod fieri debuit, si universa massa aquarum naturam haberet ebullientem per vices, et cum æstu maris consensionem. Sed contra raro admodum fit, ut instar miraculi fere habeatur; quia scilicet hujusmodi laxamenta et spiracula quæ a puteis ad mare pertingunt absque obturatione aut impedimento raro admodum inveniantur. Neque abs re est memorare quod referunt nonnulli, in fodinis profundis, non procul a mari sitis, aërem incrassari et suffocationem minari ad tempora fluxus maris; ex quo manifestum videri possit non aquas ebullire (nullæ cum cernuntur), sed aërem retroverti. At certe aliud urget experimentum non contemnendum, sed magni ponderis, cui responsio omnino debetur; hoc est, quod diligenter observatum sit, idque non fortuito notatum sed de industria inquisitum atque repertum, aquas ad littora adversa Europæ et Floridæ iisdem horis ab utroque littore refluere, neque deserere littus Europæ cum advolvantur ad littora Floridæ, more aquæ (ut supra diximus) agitatæ in pelvi, sed plane simul ad utrumque littus attolli et demitti.[1] Verum hujus objectionis solutio perspicue apparebit in iis quæ mox dicentur de cursu et progressu oceani. Summa autem rei talis est, quod aquæ a mari Indico profectæ, et ab objectu terrarum veteris et novi orbis impeditæ, truduntur per mare Atlanticum ab Austro in Boream; ut non mirum sit eas ad utrumque littus simul ex æquo appellere, ut aquæ solent quæ contruduntur a mari in ostia et canales fluminum, in quibus evidentissimum est motum maris esse progressivum

[1] See the note on *Nov. Org.* II. 36., where Acosta's name is mentioned in connexion with this statement. [See also the preface; supra p. 244.]

quatenus ad flumina, et tamen littora adversa simul inundare. Verum id pro more nostro ingenue fatemur, idque homines attendere et meminisse volumus: si per experientiam inveniatur fluxus maris iisdem temporibus ad littora Peruviæ atque Chinæ affluere quibus fluunt ad littora præfata Europæ et Floridæ, opinionem hanc nostram, quod fluxus et refluxus maris sit motus progressivus, abjudicandam esse. Si enim per littora adversa tam maris Australis quam maris Atlantici fiat fluxus ad eadem tempora, non relinquuntur in universo alia littora per quæ refluxus ad eadem illa tempora satisfaciat. Verum de hoc judicio faciendo per experientiam (cui causam submisimus) loquimur tanquam securi. Existimamus enim plane, si summa hujus rei per universum terrarum orbem nobis cognita foret, satis æquis conditionibus istud fœdus transigi, nempe ut ad horam aliquam certam fiat refluxus in aliquibus partibus orbis, quantum fiat fluxus in aliis. Quamobrem ex iis quæ diximus, statuatur tandem motus iste fluxus et refluxus esse progressivus.

Sequitur jam inquisitio *ex qua causa, et per quem consensum rerum, oriatur atque exhibeatur iste motus fluxus et refluxus.* Omnes enim majores motus (si sunt iidem regulares et constantes) solitarii aut (ut astronomorum vocabulo utamur) ferini [1] non sunt, sed habent in rerum natura cum quibus consentiant. Itaque motus illi, tam semimenstruus incrementi quam menstruus restitutionis, convenire videntur cum motu lunæ. Semimenstruus vero ille sive æquinoctialis cum motu solis. Etiam sublationes et demissiones aquarum cum apogæis et perigæis cœlestium. Neque tamen con-

[1] See Vol. I. p. 402. note 1. —*J. S.*

tinuo sequetur (idque homines advertere volumus), quæ periodis et curriculo temporis aut etiam modo lationis conveniunt, ea natura esse subordinata, atque alterum alteri pro causa esse. Nam non eo usque progredimur, ut affirmemus motus lunæ aut solis pro causis poni motuum inferiorum qui ad illos sunt analogi, aut solem et lunam (ut vulgo loquuntur) dominium habere super illos motus maris, (licet hujusmodi cogitationes facile mentibus hominum illabantur ob venerationem cœlestium); sed et in illo ipso motu semimenstruo (si recte advertatur) mirum et novum prorsus fuerit obsequii genus, ut æstus sub noviluniis et pleniluniis eadem patiantur, cum luna patiatur contraria; et multa alia adduci possint quæ hujusmodi dominationum phantasias destruant, et eo potius rem deducant, ut ex materiæ passionibus catholicis et primis rerum coagmentationibus consensus illi oriantur, non quasi alterum ab altero regatur, sed quod utrumque ab iisdem originibus et concausis emanet. Veruntamen (utcunque) manet illud quod diximus, naturam consensu gaudere, nec fere aliquid monodicum[1] aut solitarium admittere. Itaque videndum de motu fluxus et refluxus maris sexhorario, cum quibus aliis motibus ille convenire aut consentire reperiatur. Atque inquirendum primo de luna, quomodo iste motus cum luna rationes aut naturam misceat. Id vero fieri omnino non videmus, præterquam in restitutione menstrua: nullo modo enim congruit curriculum sexhorarium (id quod nunc inquiritur) cum curriculo menstruo; neque rursus fluxus maris passiones lunæ quascumque sequi deprehenduntur. Sive enim luna sit aucta lumine sive diminuta, sive illa sit sub terra sive super terram, sive

[1] *monadicum.* See Vol. I. p. 253. note 3. — *J. S.*

illa elevetur super horizontem altius aut depressius, sive illa ponatur in meridiano aut alibi, in nulla prorsus harum consentiunt fluxus atque refluxus.

Itaque, missa luna, de aliis consensibus inquiramus. Atque ex omnibus motibus cœlestibus constat, motum diurnum maxime curtum esse, et minimo temporis intervallo (spatio videlicet viginti quatuor horarum) confici. Itaque consentaneum est, motum istum de quo inquirimus (qui adhuc tribus partibus diurno brevior est) proxime ad eum motum referri qui est ex cœlestibus brevissimus; sed hoc rem minus premit. Illud vero longe magis nos movet, quod ita sit iste motus dispertitus ut ad diurni motus rationes respondeat; ut licet motus aquarum sit motu diurno quasi innumeris partibus tardior, tamen sit commensurabilis. Etenim spatium sexhorarium est diurni motus quadrans, quod spatium (ut diximus) in motu isto maris invenitur cum ea differentia quæ coincidat in mensuram motus lunæ. Itaque hoc nobis penitus insedit ac fere instar oraculi est, motum istum ex eodem genere esse cum motu diurno. Hoc igitur usi fundamento pergemus inquirere reliqua; atque rem omnem triplici inquisitione absolvi posse statuimus. Quarum prima est, an motus ille diurnus terminis cœli contineatur, aut delabatur et se insinuet ad inferiora? Secunda est, an maria regulariter ferantur ab oriente in occidentem, quemadmodum et cœlum? Tertia, unde et quomodo fiat reciprocatio illa sexhoraria æstuum, quæ incidit in quadrantem motus diurni, cum differentia incidente in rationes motus lunæ? Itaque quod ad primam inquisitionem attinet, arbitramur motum rotationis sive conversionis ab oriente in occidentem esse motum non proprie cœlestem, sed plane cosmicum, atque motum in fluoribus

magnis primarium, qui usque a summo cœlo ad imas aquas inveniatur, inclinatione eadem, incitatione autem (id est, velocitate et tarditate) longe diversa; ita tamen ut ordine minime perturbato minuatur celeritate quo propius corpora accedunt ad globum terræ. Videtur autem primo probabile argumentum sumi posse, quod motus iste non terminetur cum cœlo, quia per tantam cœli profunditatem, quanta interjicitur inter cœlum stellatum et lunam (quod spatium multo amplius est quam a luna ad terram), valeat atque vigeat iste motus, cum debitis decrementis suis; ut verisimile non sit naturam istiusmodi consensum, per tanta spatia continuatum et gradatim se remittentem, subito deponere. Quod autem res ita se habeat in cœlestibus, evincitur ex duobus, quæ aliter sequentur, incommodis. Cum enim manifestum sit ad sensum planetas diurnum motum peragere, nisi ponatur motus iste tanquam naturalis ac proprius in planetis omnibus, confugiendum necessario est vel ad raptum primi mobilis, quod naturæ prorsus adversatur, aut ad rotationem terræ, quod etiam satis licenter excogitatum est, quoad rationes physicas. Itaque in cœlo ita se res habet. Postquam autem a cœlo discessum est, cernitur porro iste motus evidentissime in cometis humilioribus, qui, cum inferiores orbe lunæ sint, tamen ab oriente in occidentem evidenter rotant. Licet enim habeant motus suos solitarios et irregulares, tamen in illis ipsis conficiendis interim communicant[1] cum motu ætheris et ad eandem conversionem feruntur; tropicis vero non continentur fere, nec habent regulares spiras, sed excurrunt quandoque versus polos, sed nihilominus in consecutione ab

[1] [*communicandis* in the original.] M. Bouillet's reading is *communicant*, which is doubtless right.

oriente in occidentem rotant. Atque hujusmodi motus iste licet magna acceperit decrementa (cum quo propius descendatur versus terram, eo et minoribus circulis conversio fiat, et nihilominus tardius), validus tamen utique manet, ut magna spatia brevi tempore vincere queat. Circumvolvuntur enim hujusmodi cometæ circa universum ambitum et terræ et aëris inferioris spatio viginti quatuor horarum, cum horæ unius aut alterius excessu. At postquam ad eas regiones descensu continuato perventum sit, in quas terra agit non solum communicatione naturæ et virtutis suæ (quæ motum circularem reprimit et sedat), sed etiam immissione materiali particularum substantiæ suæ per vapores et halitus crassos, iste motus immensum hebescit, et fere corruit, sed non propterea prorsus exinanitur aut cessat, sed manet languidus et tanquam latens. Etenim jam in confesso esse cœpit, navigantibus intra tropicos, ubi libero æquore motus aëris percipitur optime, et aër ipse (veluti et cœlum) majoribus circulis ideoque velocius rotat, spirare auram perpetuam et jugem ab oriente in occidentem; adeo ut qui Zephyro uti volunt, eum extra tropicos sæpius quærant et procurent.[1] Itaque non extinguitur iste motus etiam in aëre infimo, sed piger jam devenit et obscurus, ut extra tropicos vix sentiatur. Et tamen etiam extra tropicos in nostra Europa in mari, cœlo sereno et tranquillo, observatur aura quædam solisequa, quæ ex eodem genere est; etiam suspicari licet, quod hic in Europa experimur, ubi flatus Euri acris est et desiccans, cum contra Zephyri sit genialis[2] et humectans, non solum

[1] See Acosta, Hist. des Indes, iii. 4.

[2] [*generalis* in original.] This is obviously an error, the true reading is *genialis*.

ex hoc pendere, quod ille a continente, iste ab oceano apud nos spiret; sed etiam ex eo, quod Euri flatus, cum sit in eadem consequentia cum motu aëris proprio, eum motum incitet et irritet, ac propterea aërem dissipet et rarefaciat: Zephyri vero flatus, qui in contraria consequentia sit cum motu aëris, aërem in se vertat, et propterea inspisset. Neque illud contemnendum, quod vulgari observatione recipitur, nubes quæ feruntur in sublimi plerumque movere ab oriente in occidentem, cum venti circa terram ad eadem tempora flant in contrarium. Quod si hoc non semper faciunt, id in causa esse, quod sint quandoque venti contrarii, alii in alto, alii in imo; illi autem in alto spirantes (si adversi fuerint) motum istum verum aëris disturbent. Quod ergo cœli terminis non contineatur iste motus, satis patet.

Sequitur ordine secunda inquisitio; *An aquæ ferantur regulariter et naturaliter ab oriente in occidentem?* Cum vero aquas dicimus, intelligimus aquas coacervatas, sive massas aquarum, quæ scilicet tantæ sunt portiones naturæ, ut consensum habere possint cum fabrica et structura universi. Atque arbitramur plane, eundem motum massæ aquarum competere atque inesse, sed tardiorem esse quam in aëre, licet ob crassitudinem corporis sit magis visibilis et apparens. Itaque ex multis quæ ad hoc adduci possent, tribus in præsens contenti erimus experimentis, sed iisdem amplis et insignibus, quæ rem ita esse demonstrant. Primum est, quod manifestus reperiatur motus et fluxus aquarum ab oceano Indico usque in oceanum Atlanticum, isque incitatior et robustior versus fretum Magellanicum, ubi exitus datur versus occidentem; magnum itidem ex adversa parte orbis terrarum a mari Scythico in mare

Britannicum. Atque hæ consequentiæ aquarum manifesto volvuntur ab oriente in occidentem. In quo advertendum inprimis, in istis tantum duobus locis maria esse pervia et integrum circulum conficere posse; cum contra per medios mundi tractus, objectu duplici Veteris et Novi Orbis abscindantur et compellantur (tanquam in ostia fluminum) in duos illos alveos oceanorum geminorum Atlantici et Australis, qui oceani exporriguntur inter austrum et septentriones; quod adiaphorum est ad motum consecutionis ab oriente in occidentem. Ut verissime omnino capiatur motus verus aquarum ab istis quas diximus extremitatibus orbis, ubi non impediuntur, sed permeant. Atque primum experimentum hujusmodi est. Secundum autem tale.

Supponatur fluxum maris ad ostium freti Herculei fieri ad horam aliquam certam, constat accedere fluxum ad caput Sancti Vincentii tardius quam ad ostium illud; ad caput Finis-terræ tardius quam ad caput Sancti Vincentii; ad Insulam Regis tardius quam ad caput Finis-terræ; ad insulam Hechas tardius quam ad Insulam Regis; ad ingressum canalis Anglici tardius quam ad Hechas; ad littus Normannicum tardius quam ad ingressum canalis. Hucusque ordinatim; ad Gravelingam vero, verso prorsus ordine (idque magno saltu), quasi ad eandem horam cum ostio freti Herculei.[1] Hoc experimentum secundum ad experimen-

[1] These statements are taken from Nicolaus Sagrus, quoted by Patricius (*Pancosmia*, xxviii. p. 159.), and in Casmann's *Problemata Marina*, p. 165. "In die conjunctionis lunæ cum sole post mediam noctem horâ unâ cum dimidiâ, in freto Herculeo fluxus erit, et a Tariffa quæ finis freti est ad dexteram in sinum volvendo usque ad Ruttam eâdem horâ veniet. A Rutta ad Caput S. Mariæ accedet hora secunda cum quarto. A capite hôc ad Caput S. Vincentii, et ad dexteram flectendo toto Lusitano littore ad caput finis terræ, et inde ad orientem per totam Cantabricam oram, et etiam Gallicam usque ad regis insulam tribus post medinoctium horis mare

tum primum trahimus. Existimamus enim (quemadmodum jam dictum est), in mari Indico et in mari Scythico veros esse cursus aquarum, ab oriente scilicet in occidentem, pervios et integros; at in alveis maris Atlantici atque Australis compulsos et transversos et refractos ab objectu terrarum, quæ utrinque in longum ab Austro ad Boream exporriguntur, et nusquam, nisi versus extremitates, liberum dant exitum aquis. Verum compulsio illa aquarum, quæ causatur a mari Indico versus Boream, et in opposito a mari Scythico versus Austrum, spatiis immensum differunt ob differentem vim et copias aquarum. Universus igitur oceanus Atlanticus usque ad mare Britannicum cedit impulsioni maris Indici; at superior tantum Atlantici maris pars, nimirum ea quæ jacet versus Daniam et Norvegiam, cedit impulsioni maris Scythici. Hoc vero ita fieri necesse est. Etenim duæ magnæ insulæ veteris orbis et novi orbis eam sunt sortitæ figuram, atque ita exporriguntur, ut ad Septentriones latæ, ad Aus-

erit plenum. Ab hac usque ad insulam Hechas in mari medio ad decimum fere milliarium, quod nautæ vocant derotam mare erit plenum horâ tertiâ cum tribus quartis. Sed in littoribus horâ quartâ cum dimidiâ. Ad Hebas [corrige Ab Hechis] usque ad ingressum canalis Anglici aqua plena hora quinta et quarto uno in derotâ. In littoribus hora sexta cum tribus quartis. Toto vero littore Normandico usque Caletum et Neuportum aqua plena horâ nonâ. In derotâ horæ unius tribus quartis. In Canali vero mediâ horâ duodecimâ in eâdem lunæ conjunctione. . . . . A Calete vero ad Gravelingen extra canalem Anglicum in derotâ plenum sit post mediam noctem una hora cum dimidiâ, qua plenum erat, uti vidimus ad Ruttam, hæc in gradu longitudinis est nono. Gravelinge vero in gradu xxiv. ut distent gradibus xv." There is no difficulty in identifying the places here mentioned (Rutta being, of course, Rota, and the insula Regis the Ile de Ré), except in the case of Hechas. It is, however, the same as Heys, which is the old name of Noirmoutier. (See Ortellius and Mercator.) The island probably obtained the name Noirmoutier from having a monastery of black friars. The old name seems to be revived now in the form Aix.

trum acutæ sint. Maria igitur contra ad Austrum magna occupant spatia, ad Septentriones vero (ad dorsum Europæ et Asiæ atque Americæ) parva. Itaque ingens illa moles aquarum quæ venit ab oceano Indico et reflectit in mare Atlanticum, potis est compellere et trudere cursum aquarum continua successione quasi ad mare Britannicum, quæ successio est versus Boream. At illa longe minor portio aquarum quæ venit a mari Scythico, quæque etiam liberum fere habet exitum in cursu suo proprio versus occidentem ad dorsum Americæ, non potis est cursum aquarum compellere versus Austrum, nisi ad eam quam diximus metam, nempe circa fretum Britannicum. Necesse est autem ut in motibus istis oppositis sit tandem aliqua meta, ubi occurrant et conflictentur, atque ubi in proximo mutetur subito ordo accessionis; quemadmodum circa Gravelingam fieri diximus, limite videlicet accessionis Indicæ et Scythicæ. Atque inveniri Euripum quendam ex contrariis fluxibus circa Hollandiam, non solum ex ea (quam diximus) inversione ordinis horarum in fluxu, sed etiam peculiari et visibili experimento, a plurimis observatum est. Quod si hæc ita fiant, reditur ad id, ut necesse sit fieri, ut quo partes Atlantici et littora magis extenduntur ad Austrum et appropinquant mari Indico, eo magis fluxus antevertat in præcedentia, utpote qui oriatur a motu illo vero in mari Indico; quo vero magis ad Boream (usque ad limitem communem, ubi repelluntur a gurgite antistropho maris Scythici), eo tardius atque in subsequentia. Id vero ita fieri, experimentum istud progressus a freto Herculeo ad fretum Britannicum plane demonstrat. Itaque arbitramur etiam fluxum circa littora Africæ antevertere fluxum circa fretum Herculeum, et, verso ordine, flux-

um circa Norvegiam antevertere fluxum circa Suediam; sed id nobis experimento aut historia compertum non est.

Tertium experimentum est tale: Maria clausa ex altera parte, quæ *Sinus* vocamus, si exporrigantur inclinatione aliqua ab oriente in occidentem, quæ in consequentia est cum motu vero aquarum, habent fluxus vigentes et fortes: si vero inclinatione adversa, languidos et obscuros. Nam et mare Erythræum habet fluxum bene magnum, et Sinus Persicus, magis recta petens occidentem, adhuc majorem. At mare Mediterraneum, quod est sinuum maximus, et hujus partes Tyrrhenum, Pontus, et Propontis, et similiter mare Balticum, quæ omnia reflectunt ad orientem, destituuntur fere, et fluxus habent imbecillos. At ista differentia maxime elucescit in partibus Mediterranei, quæ quamdiu vergunt ad orientem, aut flectunt ad septentriones (ut in Tyrrheno et in iis quæ diximus maribus), quiete agunt absque æstu multo. At postquam se converterint ad occidentem, quod fit in mari Adriatico, insignem recuperat[1] fluxum. Cui accedit et illud, quod in Mediterraneo refluxus ille tenuis (qualis invenitur) incipit ab oceano, fluxus a contraria parte, ut aqua magis sequatur cursum ab oriente quam refusionem oceani. Atque his tantum tribus experimentis in præsentia utemur ad inquisitionem illam secundam.

Possit tamen adjici probatio quædam consentanea cum his quæ dicta sunt, sed abstrusioris cujusdam naturæ; ea est, ut petatur argumentum hujusce motus ab oriente in occidentem quem aquis adstruximus, non solum a consensu cœli (de quo jam dictum est), ubi iste motus in flore est ac fortitudine præcipua, sed

[1] M. Bouillet corrects the passage by reading *recuperant*.

etiam a terra, ubi protinus videtur cessare; ita ut ista inclinatio sive motus vere sit cosmicus, atque omnia a fastigiis cœli usque ad interiora terræ transverberet. Intelligimus enim conversionem istam ab oriente in occidentem fieri scilicet (quemadmodum revera invenitur) super polos australem et borealem. Verissime autem diligentia Gilberti nobis hoc reperit; omnem terram et naturam (quam appellamus terrestrem) non delinitam sed rigidam, et, ut ipse loquitur, robustam, habere directionem sive verticitatem latentem, sed tamen per plurima exquisita experimenta se prodentem, versus Austrum et Boream.[1] Atque hanc tamen observationem plane minuimus, atque ita corrigimus, ut hoc asseratur tantum de exterioribus concretionibus circa superficiem terræ, et minime producatur ad viscera ipsius terræ (nam quod terra sit magnes interim levi omnino phantasia arreptum est; fieri enim prorsus nequit, ut interiora terræ similia sint alicui substantiæ quam oculus humanus videt, siquidem omnia apud nos a sole et cœlestibus laxata, subacta, aut infracta sint, ut cum iis quæ talem nacta sunt locum quo vis cœlestium non penetret neutiquam consentire possint); sed quod nunc agitur, superiores incrustationes sive concretiones terræ videntur consentire cum conversionibus cœli, aëris, atque aquarum, quatenus consistentia et determinata cum liquidis et fluidis consentire queant, hoc est, non ut volvantur super polos, sed dirigantur et vertantur versus polos. Cum enim in omni orbe volubili, qui vertitur super polos certos neque habet motum centri, sit participatio quædam naturæ mobilis et fixæ; postquam per naturam consistentem sive se determi-

[1] Bacon appears to refer particularly to Gilbert, *De Magn.* vi. 4.; a passage repeated, like many others, in the *Physiol. Nova*, ii. 7.

nantem ligatur virtus volvendi, tamen manet et intenditur et unitur virtus illa et appetitus dirigendi se; ut directio et verticitas ad polos in rigidis, sit eadem res cum volubilitate super polos in fluidis.

Superest inquisitio tertia: *Unde et quomodo fiat reciprocatio illa sexhoraria æstuum, quæ incidit in quadrantem motus diurni, cum differentia quam diximus?* Id ut intelligatur, supponatur orbem terrarum universum aqua cooperiri, ut in diluvio generali. Existimamus aquas, quippe ut in orbe integro, neque impedito, semper in progressu se commoturas ab oriente in occidentem singulis diebus ad certum aliquod spatium (idque profecto non magnum, ob exsolutionem et enervationem virium hujus motus in confiniis terræ), cum ex nulla parte objectu terræ impediantur aquæ aut cohibeantur. Supponatur rursus, terram unicam insulam esse, eamque in longitudine exporrigi inter Austrum et Septentriones, quæ forma ac situs motum ab oriente in occidentem maxime frenat et obstruit; existimamus aquas cursum suum directum et naturalem ad tempus perrecturas, sed rursus ab insula illa repercussas paribus intervallis relapsuras; itaque unicum tantum fluxum maris in die futurum fuisse, et unicum similiter refluxum, atque horum singulis circiter 12 horas attributum iri. Atque ponatur jam (quod verum est et factum ipsum) terram in duas insulas divisam esse, veteris scilicet et novi orbis (nam Terra Australis situ suo rem istam non magnopere disturbat, quemadmodum nec Groenlandia aut Nova-zembla), easque ambas insulas per tres fere mundi zonas exporrigi, inter quas duo Oceani, Atlanticus et Australis, interfluunt, et ipsi nunquam nisi versus polos pervii; existimamus neces-

sario sequi, ut duo isti obices naturam duplicis reciprocationis universæ moli aquarum insinuent et communicent, et fiat quadrans ille motus diurni; ut aquis scilicet utrimque frenatis, fluxus et refluxus maris bis in die, per spatia scilicet sex horarum, se explicet, cum duplex fiat processio, et duplex itidem repercussio. Illæ vero duæ insulæ si instar cylindrorum aut columnarum per aquas[1] exporrigerentur æquis dimensionibus et rectis littoribus, facile demonstraretur et cuivis occurreret iste motus, qui jam tanta varietate posituræ terræ et maris confundi videtur et obscurari. Neque etiam est difficile conjecturam capere nonnullam, qualem isti motui aquarum incitationem tribuere consentaneum sit, et quanta spatia in uno die conficere possit. Si enim sumantur (in æstimationem hujus rei) littora aliqua ex iis quæ minus montosa aut depressa sunt et oceano libero adjacent, et capiatur mensura spatii terræ inter metam fluxus et metam refluxus interjacentis, atque illud spatium quadruplicetur propter æstus singulis diebus quaternos, atque is numerus rursus duplicetur propter æstus ad adversa littora ejusdem oceani, atque huic numero nonnihil in cumulum adjiciatur, propter omnium littorum altitudinem, quæ ab ipsa fossa mari semper aliquantum insurgunt; ista computatio illud spatium productura est, quod globus aquæ uno die, si liber ab impedimento esset ac in orbe circa terram semper in progressu moveret, conficere possit; quod certe nil magnum est. De differentia autem illa quæ coincidit in rationes motus lunæ, et efficit periodum menstruam; id fieri existimamus, quod spatium sexhorarium non sit mensura exacta reciprocationis, quemadmodum nec motus diurnus alicujus planetarum non[2] restituitur exacte

[1] *quas* in the original. — *J. S.* [2] So in the original. — *J. S.*

in horis 24, minime autem omnium luna. Itaque mensura fluxus et refluxus non est quadrans motus stellarum fixarum, qui est 24 horarum, sed quadrans diurni motus lunæ.

Mandata.

Inquiratur utrum hora fluxus circum littora Africæ antevertat horam fluxus circa fretum Herculeum? Inquiratur utrum hora fluxus circa Norvegiam antevertat horam fluxus circa Suediam, et illa[1] similiter horam fluxus circa Gravelingam?

Inquiratur utrum hora fluxus ad littora Brasiliæ antevertat horam fluxus ad littora Hispaniæ Novæ et Floridæ?

Inquiratur utrum hora fluxus ad littora Chinæ non inveniatur ad vel prope horam fluxus ad littora Peruviæ, et ad vel prope horam refluxus ad littora Africæ et Floridæ?

Inquiratur quomodo hora fluxus ad littora Peruviana discrepet ab hora fluxus circa littora Hispaniæ Novæ, et particulariter quomodo se habeant differentiæ horarum fluxuum ad utraque littora Isthmi in America; et rursus quomodo hora fluxus ad littora Peruviana respondeat horæ fluxus circa littora Chinæ?

Inquiratur de magnitudinibus fluxuum ad diversa littora, non solum de temporibus sive horis. Licet enim causentur fere magnitudines fluxuum per depressiones littorum, tamen nihilominus communicant etiam cum ratione motus veri maris, prout secundus est aut adversus.

Inquiratur de mari Caspio, (quæ sunt bene magnæ portiones aquarum conclusæ, absque ullo exitu in oce-

[1] *ille* in the original. — *J. S.*

anum,) si patiantur fluxum et refluxum, vel qualem; siquidem nostra fert conjectura, aquas in Caspio posse habere fluxum unicum in die, non geminatum, atque talem ut littora orientalia ejusdem maris deserantur, cum occidentalia alluantur.

Inquiratur utrum fluxus augmenta in noviluniis et pleniluniis, atque etiam in æquinoctiis,[1] fiant simul in diversis mundi partibus? Cum autem dicimus *simul*, intelligimus non eadem hora (variantur enim horæ secundum progressus aquarum ad littora, ut diximus), sed eodem die.

Moræ.

Non producitur inquisitio ad explicationem plenam consensus motus menstrui in mari cum motu lunæ; sive illud fiat per subordinationem, sive per concausam.

Syzygiæ.[2]

Inquisitio præsens conjungitur cum inquisitione, *utrum terra moveatur motu diurno?* Si enim æstus maris sit tamquam extrema diminutio motus diurni; sequetur globum terræ esse immobilem, aut saltem moveri motu longe tardiore quam ipsas aquas.

[1] *æquinoxiis* in the original. — *J. S.*
[2] *Zyzygiæ* in the original. — *J. S.*

DE PRINCIPIIS ATQUE ORIGINIBUS,

SECUNDUM FABULAS

CUPIDINIS ET CŒLI:

SIVE

PARMENIDIS ET TELESII ET PRÆCIPUE DEMOCRITI

PHILOSOPHIA,

TRACTATA IN

FABULA DE CUPIDINE.

PREFACE

TO

DE PRINCIPIIS ATQUE ORIGINIBUS.

BY ROBERT LESLIE ELLIS.

THE following tract is one of those which were published by Gruter. It seems to be of later date than many of the others, as it contains several phrases and turns of expression which occur also in the *Novum Organum*.

Bacon's design was to give a philosophical exposition of two myths; namely, that of the primeval Eros or Cupid, and that of Uranos or Cœlum. Only the first however is discussed in the fragment which we now have, and even that is left incomplete.

The philosophy of Democritus appeared to Bacon to be nearly in accordance with the hidden meaning of these fables; but we are not well able to judge of his reasons for thinking so, as the only system spoken of in detail is that of Telesius.

Touching the origin of Eros, Bacon remarks that no mention is made anywhere of his progenitors. In this he is supported by the authority of Plato, or rather by that of one of the interlocutors in the *Symposium*, who affirms that no one, whether poet or not, has

spoken of the parents of Eros; but that Hesiod in the order of his theogony places Gaia and Eros next after primeval Chaos.[1] It seems in truth probable that the fables which make Eros the son of Zeus and Aphrodite are of later origin. From the *Symposium* Bacon may also have derived the recognition of an elder and a younger Eros, of whom the former was allied to the heavenly Aphrodite, and the latter to Aphrodite Pandemus.[2] But it is more probable that his account of the distinction between them comes from some later writer.

Hesiod, to whom the first speaker in the *Symposium* refers, though he places Eros and Gaia next to Chaos, says nothing of Eros as the progenitor of the universe. His existence is recognised, but nothing is said of his offspring. In this the theogony of Hesiod differs essentially from that which is contained in the Orphic poems, and shows I think signs of greater antiquity. To recognise as a deity an abstract feeling of love or desire, is in itself to recede in some measure from the simplicity of the old world: we find no such recognition in Homer; and the transition from him to Hesiod is doubtless a transition from an earlier way of thinking to a later. But even in Hesiod Eros is not the producing principle of the universe, nor is his share in its production explained. On the other hand in the Orphic poems, Phanes, whom we are entitled to identify with Eros, is the progenitor of gods and men, the light and life of the universe. He comes forth from Chaos, uniting in his own essence the poles of

[1] Sympos. p. 178.; and see Valcknaer's Diatribe, to whom Stallbaum refers. On the other hand Pausanias mentions as an early myth that Eros was the son of Ilithyia. See Pausan. Bœot. ix. 27.

[2] Sympos. p. 180., and see also p. 195.

the mysterious antithesis on which all organic production depends. From him all other beings derive their existence. There seems clearly more of a philosopheme in this than in the simpler statements of Hesiod.

The identification of Eros with Phanes or Ericapeus rests on a passage in the *Argonautics*, in which it is said that he was called Phanes by the men of later time because he was manifested before all other beings; *πρῶτος γὰρ ἐφάνθη*.[1] It is confirmed by the authority of Proclus.

Phanes, in the common form of the Orphic theogony, comes out of the egg into which Chaos had formed itself.[2] But I am not aware that any one except Aristophanes makes Night lay the egg from which Eros afterwards emerges;[3] and it seems that this is only a playful modification of the common myth, not unsuitable to the chorus of birds by whom it is introduced.[4] It does not appear necessary to suppose, as Cudworth seemingly does, that Aristophanes had in some unexplained way become acquainted with a peculiar form of "the old atheistic cabala."[5]

The most remarkable passage in which Eros (not Phanes) is spoken of as the producer of all things, is in the *Argonautics*:—

πρῶτα μὲν ἀρχαίου χάεος μεγαλήφατον ὕμνον,
ὡς ἐπάμεψε φύσεις, ὥς τ' οὐρανὸς ἐς πέρας ἦλθεν,
γῆς τ' εὐρυστέρνου γένεσιν, πυθμένας τε θαλάσσης,

[1] Orph. Argon. 14. In the preceding line, Eros is made, according to Gesner's reading, the son of Night. But for *νία* there is another reading, *πατέρα*.

[2] See Lobeck, Aglaoph. i. 474.

[3] Aves, 650.

[4] This seems to be confirmed by the half ludicrous epithet *ὑπηνέμιον*.

[5] See Cudworth, Intellect. Syst.

πρεσβύτατόν τε καὶ αὐτοτελῆ πολύμητιν Ἔρωτα,
ὅσσά τ' ἔφυσεν ἅπαντα, τὰ δ' ἔκριθεν ἄλλου ἄπ ἄλλο.[1]

Nothing is said here, or elsewhere I believe, of his having mingled with Uranos in the engendering of the universe; and I am inclined to think that when Bacon says, "Ipse cum Cœlo mistus, et deos et res universos progenuit," we ought to substitute Chao for Cœlo.[2] For the passage in Aristophanes goes on to say that in wide Tartarus Eros and Chaos mingled in love and produced first the race of birds and then gods and men.

Of Phanes nothing of this kind is mentioned, except his intercourse with Night;[3] so that Bacon's statement does not seem to be in any way justified.

It would be endless to cite passages in which the attributes of Eros are described, nor is it necessary to do so.

The form in which Bacon connects the myth of the primeval Eros with philosophy is far less artificial and unreal than most of the interpretations which he has given in the Wisdom of the Ancients. Chaos represents uninformed matter; Eros matter actually existing, and possessed of the law or principle by which it is energised; the first principle, in short, which is the cause of all phenomena. The parents of Eros are unknown; that is to say, it is in vain to seek to carry our

[1] Argonaut. 423. In the third line πυθμένας is admitted to be corrupt. I would venture to suggest πολιᾶς, making θαλάσσης the genitive case after γένεσιν.

[2] This conjecture is confirmed by the corresponding passage in the *De Sap. Vet.*, where for *cum cœlo mistus* we have *ex chao.* — *J. S.*

[3] Lobeck, i. 501. It is to this intercourse that the line quoted by Proclus refers: —

Αὐτὸς ἐῆς γὰρ παιδὸς ἀφείλετο κούριον ἄνθος.

inquiries beyond the fact of the existence of matter possessed of such and such primitive qualities. On what do those primary qualities ultimately depend? On the "lex summa essentiæ atque naturæ . . . vis scilicet primis particulis a Deo indita, ex cujus multiplicatione omnis rerum varietas emergat et confletur." Whether this highest law can ever be discovered is by Bacon left here as elsewhere doubtful; but he does not forbid men to seek for it. But what he utterly condemns is the attempt to make philosophy rise above the theory of matter. We must ever remember that Eros has no progenitors, "ne forte intellectus ad inania deflectat"—that we turn not aside to transcendental fancies; for in these the mind can make no real progress, and "dum ad ulteriora tendit ad proximiora recidit." We must of necessity take as the starting point of our philosophy, matter possessed of its primitive qualities; and this principle is in accordance with the wisdom of those by whom the myth of Eros was constructed. And certainly, Bacon goes on to say, "that despoiled and merely passive matter is a figment of the human mind;" a statement which refers to the Aristotelian doctrine in which the primitive ὕλη is not conceived of as a thing actually existing, but as that which first receives existence through the εἶδος, wherewith it is united. Of this doctrine Bacon asserts that it is altogether trifling: "For that which primarily exists must no less exist than that which thence derives its existence;" that is to say, matter must in itself exist actually and not potentially. And the same conclusion follows from the Scriptures, "wherein it is not said that God created hyle, but that he created heaven and earth."

This application of Scripture certainly does not deserve the indignation which Le Maistre, perhaps in honest ignorance, has poured out upon it.[1] "He asserts the eternity of matter," is Le Maistre's commentary on the passage in which it occurs. Beyond doubt he denies that hyle was created, but he also denies that it exists; treating it as the mere figment of the Aristotelian philosophy.

But although Le Maistre's remark is only a fair specimen of his whole work, in which ignorance and passion are so mixed together that it is hard to say how much is to be ascribed to the one and how much to the other, yet it cannot be denied that Bacon does not appear to have understood Aristotle. So far from putting at the origin of things that which is potential, and educing the actual from it, Aristotle asserts that any system which does this is untenable; and it is curious that he refers particularly to the theogonists, οἱ ἐκ νυκτὸς γεννῶντες, who engender realities out of night.[2] For night and chaos may not unfitly be taken to represent uninformed matter.[3] The doctrine of Aristotle being in this as in other matters followed by the schoolmen, it was a question with them how the words "and the earth was without form," which come immediately after the declaration that in the beginning God created the heaven and the earth, ought to be understood. For to create the earth is to give it actual existence; how then can it be without form? To this the most satisfactory answer was that the words without form do not imply the absence of substantial

[1] Examen de la Philosophie de Bacon, ii. p. 143.

[2] Arist. Metaph. xii. 6.

[3] See Brandis's Schol. in Aristot. p. 803., and for the remarks of Alexander Aphrodisiensis, Lobeck, Aglaoph. i. 488.

form, failing which the earth could have no actual existence, but simply mean that as yet the earth was unadorned and in disorder; a solution in which we see how far they were from supposing that according to Aristotle the first created thing ought to be uninformed matter. They insist on the contrary that the Scripture cannot mean that any created thing can be mere matter: "non enim datur ens actu sine actu."

Aristotle, as I have said, condemns the theogonists in whose system Night is a producing principle, — a remark in which he may refer either to Hesiod or to the Orphic writers, but which probably relates to the former only. In the reason of this condemnation Bacon agrees with him, and yet takes into the myth which he proposes to explain, Aristophanes's fancy that the egg from which Eros came forth was laid by Night. His reason for doing so is that this part of the fable appears to him to relate not to essence but to cognition, that is to the method whereby we may arrive at a knowledge of Eros, or of the fundamental properties of matter. For conclusions obtained by means of affirmatives are, so to speak, brought forth by Light: whereas those which are obtained by negatives and exclusions are the offspring of Night and Darkness. Therefore the egg is laid by Night, seeing that the knowledge of Eros, though it is assuredly attainable, can yet only be attained by exclusions and negatives; that is, to express the same opinion in the language of the *Novum Organum*, the knowledge of Forms necessarily depends on the *Exclusiva*. That this method of exclusions must of necessity be ultimately successful is intimated by the myth itself; for the incubation of the primeval egg is not eternal. In

due time the egg is hatched and Eros is made manifest. If it be asked what analogy there is between darkness and the method of exclusions, Bacon's answer is satisfactory, — that darkness is as ignorance, and that in employing the method of exclusions we are all along ignorant of that which at any stage of the process still remains unexcluded. It may again be asked why the method of exclusions is the only one whereby Eros may be disclosed, — a question to which Bacon suggests an answer by saying that Democritus did excellently well in teaching that atoms are devoid of all sensible qualities. Bacon's opinion seems therefore to be, that any method but a negative one would necessarily fail, because that which is sought bears no analogy to any of the sensible objects by which we are surrounded. The parable, he says, maintains throughout the principles of heterogeneity and exclusion: meaning by heterogeneity a strongly marked antithesis between the fundamental qualities of matter and the sensible qualities of which we are directly cognisant. In accordance with this he censures Democritus for departing from this principle in giving his atoms the downward motion of gravity and the impulsive motion (*motus plagæ*) which belong to ordinary bodies. Not only are atoms and bodies different as touching their qualities, but also in their motions.

In these views, which however do not show either that the method of exclusions is the only one which can succeed or that it will always do so, there is much which deserves attention. They show that Bacon had obtained a deep insight into the principles of the atomic theory. The earlier developments

of this theory have always been encumbered by its being thought necessary, in order to explain phenomena, to ascribe to the atoms properties which in reality belong only to the bodies which they compose; that is, by its being thought necessary to break through Bacon's principle of heterogeneity. Thus the atoms have been supposed of definite sizes and figures, thereby resembling other and larger bodies, and to be perfectly hard and unyielding. When freed from these subsidiary hypotheses, the atomic theory becomes a theory of forces only, and of whatever ulterior developments it may be capable, these can only be introduced when it has assumed this form. The speculations of Boscovich do not mark the farthest point to which the atomic theory may be carried, but they were nevertheless an essential step in advance, and altogether in accordance with what Bacon has here said, though in an obscure and somewhat abrupt manner. "We do well," remarks Leibnitz, "to think highly of Verulam, for his hard sayings have a deep meaning in them:" a judgment which may not improbably have had a particular reference to the views now spoken of. For Leibnitz's own monadism is in effect only an abstract atomic theory:[1] more abstract doubtless than any thing which Bacon had conceived of, but yet a system which might have been derived from that of Democritus by insisting on and developing Bacon's principle of heterogeneity. And again, in a different point of view, it seems not unlikely that Leibnitz perceived an analogy between his own doctrine and that of Bacon. In the earlier part of

[1] The monad, Leibnitz himself remarks, is a metaphysical point, or formal atom.

his philosophical life, Leibnitz was disposed to agree with the opinion common among the reformers of philosophy, that what Aristotle had said of matter, of form, and of mutation, was to be explained by means of magnitude, figure, and motion. This opinion he ascribes to all the reformers of the seventeenth century, mentioning by name Bacon and several others.[1] Thirty years afterwards, in giving some account of the history of his opinions, he says that he came to perceive, "que la seule considération d'une masse étendue ne suffisoit pas, et qu'il falloit employer encore la notion de la force, qui est très-intelligible, quoiqu'elle soit du ressort de la Métaphysique."[2] In introducing this notion of force, he conceived that he was rehabilitating the Aristotelian or scholastic philosophy, seeing "que les formes des Anciens ou Entelechies ne sont autre chose que les forces."[3] These primitive forces[4] being the constituent forms of substances, he supposed them, with one exception (founded on dogmatic grounds), to have been created at the beginning of the world. The "lex a Deo lata" at the creation "reliquit aliquod sui expressum in rebus vestigium," namely an efficacy, or form, or force, by virtue of which and in accordance with the divine precept all phenomena had been engendered.[5]

If we compare these expressions, which contain the fundamental idea of Leibnitz's philosophy, with those which have already been quoted from the following tract, we shall I think perceive more than an acci-

[1] Epist. ad Thomas. p. 48. of Erdmann's edition of Leibnitz's Phil. Works.
[2] Système nouveau, p. 124., Erdmann.
[3] Lettre à Bouvet, p. 146., Erdmann.
[4] Forces primitives, v. Syst. Nouv.
[5] See his De ipsâ Naturâ, p. 156.

dental analogy between them. Leibnitz speaks of the primitive forces impressed by the divine word on created things, "ex quâ series phenomenorum ad primi jussûs præscriptum consequeretur," — and Bacon of the "lex summa essentiæ et naturæ, vis scilicet primis particulis a Deo indita, ex cujus multiplicatione omnis rerum varietas emergat et confletur." It does not seem improbable that Leibnitz, who in the letter to Thomasius classes Bacon, so far as relates to the present subject, with Gassendi and Descartes, came afterwards to find in Bacon's language hints of the deeper view which he had himself been led to adopt, and which constitutes the point of separation between his system and the Cartesian. This supposition would at least be in accordance with the emphatic manner in which he has contrasted the physical theories of Descartes and Bacon, taking the former as a type of acuteness and the latter of profundity, and asserting that compared with Bacon, Descartes seems to creep along the ground.[1]

It may not be out of place here to remark that there are other traces of Bacon's influence on Leibnitz. In Erdmann's edition of his philosophical works, we find several fragmentary papers which Leibnitz wrote under the name of Gulielmus Pacidius. The title of one of these is "Gulielmi Pacidii Plus Ultra, sive initia et specimina scientiæ generalis de instauratione et augmentis scientiarum ac de perficiendâ mente rerumque inventione ad publicam fœlicitatem." Plus Ultra was the motto to Bacon's device of a ship sailing through the Pillars of Hercules, and the remainder of the title is both in tone and language clearly Baconian. The

[1] Leibnitiana, vol. vi. p. 303., ed. Genev. 1768. — *J. S.*

work itself was to have concluded with an exhortation "ad viros dignitate doctrinâque egregios de humanâ fœlicitate exiguo tempore, si velimus modo, in immensum augendâ."[1]

Another of these fragments contains some account of himself, or rather of Wilhelmus Pacidius, in which he mentions it as one of the happy incidents of his youth, that when he had perceived the defects of the scholastic philosophy the writings of several of the reformers came into his hands — among which he gives the first place to the "consilia magni viri Francisci Baconi Angliæ Cancellarii de augmentis Scientiarum."[2]

To return to the fable of Cupid. After interpreting the statement that all things come from Eros to mean that all phenomena must be referred to the fundamental and originally inherent properties of matter as the first ground of their production, Bacon goes on to say that next to the error of those who make formless matter an original principle, is the error of ascribing secondary qualities to primitive matter. This he expresses by saying that though Eros is endued with personality, he is nevertheless naked, "ita personatus[3] ut sit tamen nudus." Those who have committed the error of clothing him have either merely covered him with a veil, or have dressed him up in a tunic, or lastly have wrapped him round with a cloak.

These three errors are respectively the errors of those who have sought to explain everything by the transformations of one element as air or fire, — of those who assume a plurality of elements, — and of those who

[1] Leibnitz, ab Erd. p. 89. [2] Ibid. p. 91.

[3] The meaning of *personatus* appears from the phrase Bacon previously uses: "Cupidinis est persona quædam."

assume an infinity of first principles (the homœomeria of Anaxagoras), each possessed of specific properties.

Contrasted with these errors is the doctrine that there is one first material principle, "idque fixum et invariabile," and that all phenomena are to be explained, "per hujusmodi principii . . . magnitudines figuras et positiones," — a statement which includes along with the old atomic theory every such hypothesis as the Cartesian. By those only who hold this opinion is Eros rightly displayed; they show him as he really is, "nativus et exutus."

In the interval between writing this tract and the *Novum Organum* Bacon's opinions seem to have undergone some change, as he has there condemned the atomists for asserting the existence of "materia non fluxa;" an obscure phrase, but which appears irreconcilable with the expression which I have just quoted — "fixum et invariabile."

However this may be, Bacon next proceeds to enumerate the different forms of doctrine into which the doctrine of a single element has been subdivided. The first principle or primitive matter has been asserted to be water, or air, or fire. Something is then said of the opinions of Thales, of Anaximenes, and of Heraclitus, and they are collectively commended for having given Eros but a single garment, that is, for having ascribed to primitive matter only a single form substantially homogeneous with any of the forms of secondary existences.

The Anaxagorean doctrine of an infinity of elements is then set aside as belonging to the interpretation of the fable of Cœlum, and thus Bacon comes to the doctrine of two opposing principles, with which the re-

mainder of the tract is taken up. Parmenides, he observes, among the ancients, and Telesius in modern times, had made fire and earth, or heaven and earth, the two first principles.

In connecting together Telesius and Parmenides Bacon overlooked an essential point of difference. For the system of Telesius is merely physical, it deals only with phenomena, and seeks for no higher grounds of truth than the evidence of the senses. Parmenides, on the other hand, recognised the antithesis of τὸ ὄν and τὸ φαινόμενον, of that which exists and that which is apparent. His doctrine is ontological rather than physical, and he does not admit that phenomena have any connexion with real or essential truth. He seeks for a deeper insight into things than any which a mere "Welt-anschauung," a mere contemplation of the universe, could be made to furnish. The hypothesis which he framed to explain the phenomena by which we are surrounded, is with him a hypothesis merely, and though, like Telesius's, this hypothesis refers every phenomenon to the antagonism of heat and cold, yet it has a character of its own, inasmuch as in a way not distinctly conceivable it also serves to represent the metaphysical antithesis of τὸ ὄν and τὸ μὴ ὄν.

It is however to be remembered that with the ontological aspect of the philosophy of Parmenides Bacon has here no concern.

The fundamental notion of Telesius's system was doubtless suggested both to him and to Parmenides,[1] by certain obvious phenomena, and especially by the

[1] The same notion is ascribed also to Hippo of Rhegium, and to others of the Greek philosophers. See *Pseudo-Orig. Philos.* (16.), for the fullest statement as to Hippo.

growth, decay, and reproduction of plants and animals. But it is essentially derived from the delight which the mind takes in every form of antithetic dualism, and especially in the idea of the reciprocal action of opposing forces. It comes from the same source as the love and strife of Empedocles, and as the good and evil principles of the Persian theology.

By the help of this notion, namely that heat and cold are the constituent principles of the universe, Telesius attempts to give general explanations of all phenomena, leaving it to others to study them in detail. The largeness of his plan and the grave eloquence with which it is set forth won for him some celebrity, notwithstanding the extreme obscurity of his style and the vagueness of his whole doctrine.

The academy of Cosenza (it was at Cosenza that Telesius was born) adopted his views, and both there and elsewhere men were for some time to be found who called themselves Telesiani. Spiriti, in his *Scrittori Cosentini*, gives a list of the disciples of Telesius; it contains however no name of much note, except that of Campanella, and the fame of Campanella rests much more on his moral and political speculations than on his defence of Telesius. Giordano Bruno and Patricius cannot be called disciples of Telesius, though the writings of both bear traces of his influence.[1] Among real students of nature it was not to be expected that

[1] The influence of Telesius on Bruno is not, I think, mentioned by historians of philosophy, yet there is no doubt of its existence. In the following passage the fundamental principle of Telesius is plainly assumed, mingled with ideas derived from Copernicus. "Così vien distinto l' universo in fuoco et acqua, che sono soggetti di doi primi principii formali et attivi, freddo et caldo. Que' corpi che spirano il caldo, son le sole, che per se stesso son lucenti et caldi; que' corpi che spirano il freddo son le terre." — *Cena di Cenere*, p. 174. of Wagner's edition.

so indefinite a system as that of Telesius could find much acceptance, and accordingly it is but seldom mentioned by scientific writers. Grassi, in the *Libra Astronomica*,[1] seems to reproach Galileo with having taken some notion about comets from Cardan and Telesius; remarking that their philosophy was sterile and unfruitful, and that they had left to posterity "libros non liberos." To this Galileo answers that as for what Cardan and Telesius might have said on the matter in hand he had never read it, and it would seem as if he means to disclaim all knowledge of their writings. Though he protests against the argumentum ex consensu which Grassi brings against them, yet it is plain that he does so only to confute his opponent, and not because he thought them worthy of a greater fame than they had received. Even among the large class of men who are content to acquiesce in general views and are not careful to inquire whether these views are accurate or ill defined, Telesius's popularity could not last long. For he had left nothing for his followers to do. All that could be said in favour of his fundamental idea he had said himself, and any attempt to develop it further could only show how insecure a foundation it was built on. His works are however not undeserving of attention, even apart from the influence which they had on the opinions of Bacon. They show much of the peculiar character of mind which distinguishes southern from northern Italy, and which is yet more conspicuous in the writings of Campanella and of Vico: grave and melancholy earnestness, — a fondness for symbol and metaphor, and for wide-reaching but dreamy theories.

[1] Published in 1618, with the pseudonym of Lotario Sarsi. It is incorporated in the new edition of Galileo's works, iv. p. 61.

The first two books of his principal work, the *De Rerum Naturâ*, were published at Rome in 1565. The complete work was not published until 1586, only two years before his death.[1] In 1590 a number of tracts, some of which had appeared in his lifetime, were published by Antonius Persius, one of his chief disciples, with a dedication to Patricius, which seems to claim him as at least half an adherent to the Telesian philosophy.[2] For some account of Telesius's minor works I may refer to Spiriti's *Scrittori Cosentini*, or to what Salsi has said of them in Ginguené's *Histoire Littéraire de l'Italie*.[3]

Of Lotter's work, *De Vita et Scriptis B. Telesii*, Leipsic, 1733, I much regret that I only know what is said of it in the *Acta Eruditorum* for that year. It appears to contain much information not easily to be found elsewhere.

The view which Bacon gives of the doctrines of Telesius seems to have been much used and trusted by the historians of philosophy,[4] — a natural result of the involved and obscure style in which they were originally propounded. Whether it is altogether an accurate representation of these doctrines may at least be doubted: it seems as if Bacon, in some matters of detail, mingles with what he finds in Telesius some further developments of his own. Perhaps he is in some

[1] It was reprinted in 1588, along with the *Contemplationes* of Mocenicus and the *Quæstiones Peripateticæ* of Cæsalpinus. The volume containing these three works is entitled "Tractationum Philosophicarum tomus unus," and is apparently not easily met with. It is this edition that I have been in the habit of using.

[2] This dedication is prefixed to the tract "De Mari."

[3] The account of Telesius in Ginguené was written by Salsi. See Ginguené, vii. p. 500.

[4] See what Brucker says of Morhof and Sosellus, *Hist. Crit. Phil.* iv. 453.

measure influenced by his jural habits of thought, and tries in all fairness and equity to put a favourable construction on that on which he sits in judgment.[1] However this may be, I have certainly found it difficult to support all his statements by quotations from his author, and in some cases have noticed at least apparent discrepancies.

The tract ends abruptly with the discussion of the system of Telesius. A similar discussion of the atomic theory would have been of far greater interest, for Bacon's own opinions are much more closely connected with those of Democritus than with Telesius's, from whom he derived only isolated doctrines. The most important of these doctrines is that of the duality of the soul, of which and of its relation to the orthodox opinion I have elsewhere had occasion to speak.[2]

[1] Bacon's own language suggests this impression. "Nos enim," he declares, "in omnium inventis summâ cum fide et tanquam faventes versamur." And that he does not conceive himself bound to minute accuracy in reproducing the opinions of the philosophers of whom he speaks, appears from several expressions: "Hujusmodi quædam de diversitate calorum a Telesio dicuntur;" "Hæc, aut iis meliora, cogitabant illi," &c.

[2] See General Preface, Vol. I. p. 102. — *J. S.*

DE PRINCIPIIS ATQUE ORIGINIBUS,

SECUNDUM FABULAS

CUPIDINIS ET CŒLI:

ETC.

Quæ de Cupidine sive Amore ab antiquis memorata sunt, in eandem personam convenire non possunt; quinetiam ab ipsis ponuntur Cupidines duo, et longo sane intervallo discrepantes; cum unus ex iis deorum antiquissimus, alter natu minimus fuisse diceretur. Atque de antiquo illo nobis in præsentia sermo est. Narrant itaque Amorem illum omnium deorum fuisse antiquissimum, atque adeo omnium rerum, excepto Chao, quod ei coævum perhibetur. Atque Amor iste prorsus sine parente introducitur. Ipse autem cum Chao[1] mistus, et deos et res universas progenuit. A nonnullis tamen ovo prognatus[2] incubante Nocte traditus est. Ejus

[1] *Cælo* in the original. For the grounds of the correction, see Preface, p. 274. — *J. S.*

[2] Kellgren, *De Ovo mundano* (Helsingfors, 1849), has collected the passages on the egg cosmogony in the Institutes of Menu, the Putanas, and certain Commentaries. He remarks that, so far as he is aware, no trace of the mythus occurs in the Vedas. It follows that he did not perceive any reference to it in the 129th hymn of the 10th book of the Rig Veda, with which he was certainly acquainted, as he has quoted a portion of Colebrook's translation of it. In this translation it is difficult to recognise even

vero attributa ponuntur diversa, ut sit infans perpetuus, cæcus, nudus, alatus, sagittarius. Vis autem ejus præcipua et propria ad corpora unienda valet: etiam claves ætheris, maris, et terræ ei deferebantur. Fingitur quoque et celebratur alter Cupido minor, Veneris filius, in quem attributa antiquioris transferuntur, et propria multa adjiciuntur.

Fabula ista, cum sequenti de Cœlo, brevi parabolæ complexu proponere videtur *doctrinam de principiis rerum et mundi originibus*, non multum dissidentem ab ea philosophia quam Democritus exhibuit; nisi quod videatur aliquanto magis severa, et sobria et perpurgata. Ejus enim viri, licet acutissimi et diligentissimi, contemplationes gliscebant tamen, et modum tenere nesciæ erant, nec se satis stringebant aut sustinebant. Atque etiam hæc ipsa placita quæ in parabola delitescunt, quamvis paulo emendatiora, talia sunt qualia esse possunt illa quæ ab intellectu sibi permisso, nec ab experientia continenter et gradatim[1] sublevato, profecta videntur; nam illud vitium existimamus etiam prisca secula occupasse. In primis autem intelligendum est, quæ hic afferuntur conclusa et prolata esse ex authoritate rationis humanæ solummodo, et sensus fidem secuta: cujus jampridem cessantia et deficientia oracula merito rejiciuntur, postquam meliora et certiora mortalibus ex parte verbi divini affulserint. Itaque Chaos illud, quod Cupidini coævum erat, massam sive con-

the germ of the mythus, but in that which has since been given by Max Müller it seems more easy to do so. It would be interesting to ascertain how far the mythus was developed at the time at which the older portions of the Rig Veda were composed. The subject may be said to have a natural interest at Helsingfors, as the egg cosmogony exists among the Finns. For the hymn referred to see Colebrook's *Miscellaneous Essays*, i. p. 34., and Müller's Addenda to Bunsen's *Hippolytus*, p. 140.

[1] *gradatum* in original. — *J. S.*

gregationem materiæ inconditam significabat. Materia autem ipsa, atque vis et natura ejus, denique principia rerum, in Cupidine ipso adumbrata erant. Ille introducitur sine parente, id est sine causa: causa enim effectus veluti parens est; idque in tropis familiare et fere perpetuum est, ut parens et proles causam et effectum denotent. Materiæ autem primæ, et virtutis atque actionis propriæ ejus, causa nulla esse potest in natura (Deum enim semper excipimus); nihil enim hac ipsa prius. Itaque efficiens nulla, nec aliquid naturæ notius; ergo nec genus, nec forma. Quamobrem quæcunque tandem sit illa materia atque ejus vis et operatio, res positiva est et surda, atque prorsus ut invenitur accipienda, nec ex prænotione aliqua judicanda. Etenim modus si sciri detur, tamen per causam sciri non potest, cum sit post Deum causa causarum, ipsa incausabilis. Est enim terminus quidam verus et certus causarum in natura: atque æque imperiti est et leviter philosophantis, cum ad ultimam naturæ vim et legem positivam ventum sit causam ejus requirere aut fingere, ac in iis quæ subordinata sunt causam non desiderare.[1] Quare Cupido ab antiquis sapientibus ponitur in parabola sine parente, id est, sine causa. Neque nihil in hoc est; imo haud scimus an non res omnium maxima. Nil enim philosophiam peræque corrupit ac illa inquisitio parentum Cupidinis; hoc est, quod philosophi principia rerum quemadmodum in natura inveniuntur non receperunt et amplexi sunt, ut doctrinam quandam positivam, et tanquam fide experimentali; sed potius ex legibus sermonum et ex dialecticis et mathematicis conclusiunculis atque ex communibus notionibus et hujusmodi mentis extra

[1] Compare *Nov. Org.* i. 48.

naturam exspatiationibus ea deduxerunt. Itaque philosophanti quasi perpetuo hoc animo agitandum est, non esse parentes Cupidini, ne forte intellectus ad inania deflectat; quia in hujusmodi perceptionibus universalibus gliscit animus humanus, et rebus et se ipso abutitur, et dum ad ulteriora tendit ad proximiora recidit.[1] Cum enim, propter angustias suas, iis quæ familiariter occurrunt et quæ una et subito mentem subire et ferire possunt maxime moveri consuerit; fit ut cum ad ea quæ secundum experientiam maxime universalia sunt se extenderit, et nihilominus acquiescere nolit, tum demum, tanquam adhuc notiora appetens, ad ea quæ ipsum plurimum affecerint aut illaqueaverint se vertit, et ea ut magis causativa et demonstrativa quam ipsa illa universalia sibi fingit.

Itaque quod prima rerum essentia, vis, et Cupido, sine causa sit, jam dictum est. De modo vero ejus rei (quæ causam non recipit) videndum. Modus autem et ipse quoque perobscurus est; idque a parabola ipsa monemur, ubi eleganter fingitur Cupido, ovum Nocte incubante exclusum. Certe sanctus philosophus ita pronuntiat: *Cuncta fecit Deus pulchra tempestatibus suis, et mundum tradidit disputationibus eorum; ita tamen ut non inveniat homo opus quod operatus est Deus a principio usque ad finem.*[2] Lex enim summa essentiæ atque naturæ, quæ vicissitudines rerum secat et percurrit (id quod ex verborum complexu describi videtur, *opus quod operatus est Deus a principio usque ad finem*), vis scilicet primis particulis a Deo indita, ex cujus multiplicatione omnis rerum varietas emergat et confletur, cogitationem mortalium perstringere potest, subire vix potest. Aptissime autem refertur illud de ovo Noctis

[1] Compare Nov. Org. i. 48. [2] Eccles. iii. 11.

ad demonstrationes per quas Cupido iste in lucem editur. Quæ enim per affirmativas concluduntur, videntur partus lucis; quæ vero per negativas et exclusiones, ea tanquam a tenebris et nocte exprimuntur et educuntur. Est autem iste Cupido vere ovum exclusum a Nocte; notitia enim ejus (quæ omnino haberi potest) procedit per exclusiones et negativas. Probatio autem per exclusionem facta, quædam ignoratio est, et tanquam *nox*, quoad id quod includitur; quare præclare Democritus atomos sive semina, atque eorum virtutem, nullius rei similia quæ sub sensum cadere posset asseruit; sed ea prorsus cæca et clandestina natura insignit. Itaque de ipsis pronuntiavit:

> Neque sunt igni simulata, neque ulli
> Præterea rei quæ corpora mittere possit
> Sensibus, et nostros adjectu tangere tactus: [1]

Et rursus de virtute eorum:

> At primordia gignundis in rebus oportet
> Naturam clandestinam cæcamque adhibere,
> Emineat ne quid, quod contra pugnet et obstet.[2]

Itaque atomi neque ignis scintillis, neque aquæ guttis, neque auræ bullis, neque pulveris granis, neque spiritus aut ætheris minutiis, similes sunt. Neque vis et forma eorum aut grave quiddam est aut leve, aut calidum aut frigidum, aut densum aut rarum, aut durum aut molle, qualia in corporibus grandioribus inveniuntur; cum istæ virtutes, et reliquæ id genus, compositæ sint et conflatæ. Neque similiter motus naturalis atomi aut motus ille est descensus, qui appellatur naturalis, aut motus illi oppositus (plagæ), aut motus expansionis et contractionis, aut motus impulsionis et nexus, aut motus rotationis cœlestium, aut quispiam ex aliis motibus

[1] Lucret. i. 688. [2] Id. i. 779.

grandiorum, simpliciter. Atque nihilominus et in corpore atomi elementa omnium corporum, et in motu et virtute atomi initia omnium motuum et virtutum insunt. Veruntamen in hoc ipso, nimirum de motu atomi, collato ad motum grandiorum, philosophia parabolæ a philosophia Democriti dissentire videtur. Democritus enim non omnino parabolæ tantum, sed et sibi quoque impar et fere contrarius reperitur, in iis quæ amplius ab eo circa hoc dicta sunt. Debuit enim motum heterogeneum atomo tribuere, non minus quam corpus heterogeneum et virtutem heterogeneam. Verum ille motus duos, descensus gravium et adscensus levium (quem per plagam sive percussionem magis gravium pellendo minus gravia in superius expediebat), delegit ex motibus grandiorum, quos atomo ut primitivos communicaret.[1] Parabola autem heterogeneam et exclusionem ubique tuetur, tam substantia quam motu. At parabola ulterius innuit, harum de quibus diximus exclusionum finem aliquem et modum esse; neque enim perpetuo Nox incubat. Atque Dei certe proprium est, cum de ejus natura inquiritur per sensum, ut exclusiones in affirmativis non terminentur. Alia vero est hujus rei ratio; ea scilicet, ut post debitas exclusiones et negationes aliquid affirmetur et constituatur, et ut ovum quasi a tempestiva et matura incubatione excludatur; neque tantum ovum excludatur Nocte, sed etiam ex ovo excludatur persona Cupidinis; hoc est, ut non tantum educatur et extrahatur hujusce rei notio quædam

1 "Cuncta necesse est
Aut gravitate sua ferri primordia rerum,
Aut ictu forte alterius." LUCRET. ii. 82.

But Democritus himself did not ascribe gravity to the atom, and in this as in some other points Bacon was misled by assuming that Lucretius always represents the opinions of Democritus. See Stobæus, Eclog. Phys. i. 15.

ex ignoratione, verum etiam notio distincta et confusa.[1] Atque de demonstrationibus, quales eæ circa materiam primam esse possint, hæc habùimus quæ cum sensu parabolæ maxime convenire arbitramur. Veniendum igitur ad Cupidinem ipsum, materiam scilicet primam, et dotes ejus, quas tanta circumstat nox; et videndum quid parabola ad illam lucis afferat. Neque nos fugit, opiniones hujusmodi duras et fere incredibiles ad hominum sensus et cogitationes accedere. Atque ejus certe rei periculum jam factum esse plane cernimus in hac ipsa Democriti philosophia de atomis, quæ quia paulo acutius et altius in naturam penetrabat et a communibus notionibus erat remotior, a vulgo pueriliter accipiebatur; sed et philosophiarum aliarum quæ ad vulgi captum magis accedebant disputationibus, tanquam ventis, agitata et fere exstincta est. Et tamen etiam ille vir suis temporibus summa admiratione floruit, et *Pentathlus* dictus est ob multiplicem scientiam,[2] et inter omnes philosophos omnium consensu maxime physicus est habitus, ut Magi quoque nomen obtineret. Neque Aristotelis pugnæ et dimicationes (qui Ottomannorum more de regno suo philosophiæ anxius erat, nisi fratres trucidasset; cui etiam curæ erat, ut ex ejus verbis liquet, ne quid posteri scilicet dubitarent) tantum sua violentia, nec etiam Platonis majestas et solennia tantum reverentia potuerunt, ut philosophiam hanc Democriti delerent. Sed dum illa Aristotelis et Platonis strepitu et pompa professoria in scholis circumsonarent et celebrarentur, hæc ipsa Democriti apud sapientiores, et contemplationum silentia et ardua arc-

[1] So in the original. I suppose *minime*, or some equivalent word, has dropped out. M. Bouillet suggests the substitution of *nec* for *et*. — *J. S.*

[2] Diog. Laert. ix. 37. But see Mullach. Quæst. Democ. p. 54.

tius complexos, in magno honore erat. Certe in seculis illis Romanæ doctrinæ, illa Democriti et mansit et placuit; cum Cicero ejus viri ubique summa cum laude mentionem faciat, et non ita multo post præconium illud poëtæ, qui videtur ex temporis sui judicio (ut solent illi) de eo locutus esse, conscriptum sit et exstet,

> Cujus prudentia monstrat
> Magnos posse viros, et magna exempla daturos,
> Vervecum in patria crassoque sub aëre nasci.[1]

Itaque non Aristoteles aut Plato, sed Gensericus et Attila et barbari, hanc philosophiam pessundederunt. Tum enim, postquam doctrina humana naufragium perpessa esset, tabulæ istæ Aristotelicæ et Platonicæ philosophiæ, tanquam materiæ cujusdam levioris et magis inflatæ, servatæ sunt, et ad nos pervenerunt, dum magis solida mergerentur et in oblivionem fere venirent. Nobis vero digna videtur Democriti philosophia quæ a neglectu vindicetur, præsertim quando cum authoritate prisci seculi in plurimis consentiat. Primo itaque describitur Cupido ut persona quædam; eique attribuuntur Infantia, Alæ, Sagittæ, alia, de quibus sigillatim postea dicemus. Sed hoc interim sumimus; antiquos proposuisse materiam primam (qualis rerum principium esse potest) formatam et dotatam, non abstractam, potentialem, informem. Atque certe materia illa spoliata et passiva prorsus humanæ mentis commentum quoddam videtur, atque inde ortum, quia intellectui humano illa maxime esse videntur, quæ ipse potissimum haurit, et quibus ipse plurimum afficitur. Itaque fit ut formæ (quas vocant) magis existere videantur, quam aut materia aut actio: quod illa latet, hæc

[1] Juv. x. 48.

fluit; altera non tam fortiter impingitur, altera non tam constanter inhæret. Imagines autem illæ, contra, et manifestæ et constantes putantur; adeo ut materia illa prima et communis tanquam accessorium quiddam videatur, et loco suffulcimenti; actio autem quævis tanquam emanatio tantum a forma; atque prorsus primæ partes formis deferantur. Atque hinc fluxisse videtur formarum et idearum regnum in essentiis, materia scilicet addita quadam phantastica. Aucta etiam sunt ista superstitione nonnulla (errorem, intemperantiam,[1] ut fit, secuta), et ideæ abstractæ quoque introductæ, et earum dignitates; tanta confidentia et majestate, ut cohors somniantium vigilantes fere oppresserit. Verum ista ut plurimum evanuerunt; licet alicui, nostro hoc seculo, curæ fuerit ea sponte inclinantia fulcire et excitare, majore ausu (ut nobis videtur) quam fructu.[2] Verum quam præter rationem materia abstracta principium ponatur (nisi obstent præjudicia) facile perspicitur. Formas siquidem separatas quidam actu subsistere posuerunt,[3] materiam separatam nemo; ne ex iis qui eam ut principium adhibuerunt; atque ex rebus phan-

[1] [So in original.] The true reading is probably *intemperantiâ*.

[2] The allusion is apparently to Patricius, whose *Nova Philosophia* was published in 1593; a work long since so rare that Sorellus (apud Brucker, iv. 28.) says that a small library might be purchased for the price of this single book. See for an account of it Brucker, ubi modo.

[3] Angels are regarded by the schoolmen as forms not immersed in matter. Thus St. Thomas says, "Angeli sunt formæ immateriales." — *Sum. Theol.* i. q. 61. Even the soul of man is spoken of as a form "non penitus materiæ immersa;" a way of speaking probably employed for two reasons, — to save the possibility of the soul's separate existence, and to obviate the difficulty of the Scotists, that an unextended, or intense, form like the soul cannot give extension or corporeity. From this difficulty Duns Scotus deduced the existence of a "forma corporeitatis" distinct from the soul; a doctrine not to be confounded with that of Avicenna, who, from the impossibility of conceiving unextended matter, was led to assert the existence of a form of corporeity primitively inherent in all matter.

tasticis entia constituere durum videtur ac perversum, neque inquisitioni de principiis consonum. Neque enim quæritur quomodo naturam entium commodissime cogitatione complectamur aut distinguamus, sed quæ sint vere entia prima et maxime simplicia ex quibus cætera deriventur. Primum autem ens non minus vere debet existere, quam quæ ex eo fluunt; quodammodo magis. Authupostaton[1] enim est, et per hoc reliqua. At quæ dicuntur de materia illa abstracta, non multo meliora sunt, quam si quis mundum et res ex categoriis et hujusmodi dialecticis notionibus, tanquam ex principiis, fieri asserat. Parum enim interest, utrum quis mundum fieri ex materia et forma et privatione dicat, an ex substantia et qualitatibus contrariis.[2] Sed omnes fere antiqui, Empedocles, Anaxagoras, Anaximenes, Heraclitus, Democritus, de materia prima in cæteris dissidentes, in hoc convenerunt, quod materiam activam, forma nonnulla, et formam suam dispensantem, atque intra se principium motus habentem, posuerunt. Neque aliter cuiquam opinari licebit, qui non experientiæ plane desertor esse velit. Itaque hi omnes mentem rebus submiserunt. At Plato mundum cogitationibus, Aristoteles vero etiam cogitationes verbis, adjudicarunt; vergentibus etiam tum hominum studiis ad disputationes et sermones, et veritatis inquisitionem severiorem missam facientibus. Quare hujusmodi placita magis toto genere reprehendenda quam proprie confutanda videntur. Sunt enim eorum, qui multum loqui volunt, et parum scire. Atque abstracta ista materia est materia disputationum, non universi. Verum rite et or-

[1] The word *αὐθυπόστατος*, of which the Latin form ought to be authypostatus, is given by Stephanus, with a reference to Nicetas.

[2] Compare *De Augmentis*.

dine philosophanti, naturæ plane facienda est dissectio non abstractio (qui autem secare eam nolunt, abstrahere coguntur), atque omnino materia prima ponenda est conjuncta cum forma prima, ac etiam cum principio motus primo, ut invenitur. Nam et motus quoque abstractio infinitas phantasias peperit, de animis, vitis, et similibus, ac si iis per materiam et formam non satisfieret, sed ex suis propriis penderent illa principiis. Sed hæc tria nullo modo discerpenda, sed tantummodo distinguenda; atque asserenda materia (qualiscunque ea sit) ita ornata et apparata et formata, ut omnis virtus, essentia, actio, atque motus naturalis, ejus consecutio et emanatio esse possit. Neque propterea metuendum, ne res torpeant, aut varietas ista quam cernimus explicari non possit; ut postea docebimus. Atque quod materia prima forma nonnulla sit, demonstratur a parabola in hoc, quod Cupidinis est persona quædam. Ita tamen ut materia ex toto, sive massa materiæ, quondam informis fuerit: Chaos enim informe; Cupido persona quædam. Atque hæc cum sacris literis optime conveniunt. Neque enim scriptum est quod Deus hylen[1] in principio creavit, sed cœlum et terram.

Subjungitur etiam descriptio nonnulla status rerum qualis fuerit ante opera dierum, in qua distincta mentio fit terræ et aquæ, quæ sunt nomina formarum; sed tamen quod massa secundum totum erat informis.[2] Verum introducitur in parabolam Cupido ita personatus, ut sit tamen nudus. Itaque post illos qui materiam ponunt abstractam, proxime (sed in contrarium) peccant illi qui eam ponunt non exutam. Atque de hac

[1] *Hymen* in the original. — *J. S.*

[2] Compare St. Thomas, Sum. Theol. i. 66. 1.

re quædam adspersimus in iis quæ de demonstrationibus quales in materiam primam conveniant, et de heterogenea ipsius materiæ, a nobis jam dicta sunt. At hic, quem nunc ingrediemur, est proprius ejus rei tractandæ locus. Videndum ergo ex iis qui principia rerum in materia formata fundaverunt, quinam sint illi qui formam materiæ tribuerint nativam et hudam, et qui rursus superfusam et indutam. Inveniuntur autem omnino *quatuor opinantium sectæ*. Prima est eorum, qui unum quippiam asserunt rerum principium, diversitatem autem entium constituunt in natura ejusdem principii fluxa[1] et dispensabili. Secunda eorum, qui principium rerum ponunt substantia unicum, idque fixum et invariabile; diversitatem entium deducunt per hujusmodi principii diversas magnitudines, figuras, et posituras. Tertia eorum, qui plura constituunt rerum principia; et diversitatem entium ponunt in eorum temperamento et mistione. Quarta eorum, qui infinita aut saltem numerosa constituunt rerum principia, sed specificata et effigiata; quibus nihil opus ut comminiscantur aliquid quod res deducat ad multiplex, cum naturam jam a principio disgregent.[2] Inter quos secunda secta nobis videtur solummodo Cupidinem exhibere, ut est, nativum et exutum. Prima vero introducit eum tanquam velo discretum. Tertia tunicatum. Quarta etiam chlamydatum et fere sub larva. Atque de singulis pauca dicemus, ad meliorem parabolæ explicationem. Primo igitur, ex iis qui unum rerum principium statuerunt, neminem invenimus qui illud de Terra affirmaret. Obstabat scilicet terræ natura qui-

[1] *fluxu* in the original. — *J. S.*

[2] In enumerating these four sects, Bacon alludes successively to the Ionian physicists; to the atomists; to Parmenides, Telesius, Empedocles and many others; and lastly to Anaxagoras.

eta et torpens et minime activa, sed cœli et ignis et reliquorum patiens, ne id cuipiam in mentem veniret asserere.[1] Attamen prisca sapientia Terram proximam a Chao ponit, Cœlique primo parentem, deinde nuptam; ex quo conjugio omnia.[2] Neque propterea hoc accipiendum, ac si veteres unquam statuissent terram principium essentiæ; sed principium vel originem potius schematismi sive systematis. Itaque hanc rem ad parabolam sequentem de Cœlo rejicimus, ubi de Originibus inquiremus; quæ est inquisitio, ad illam de Principiis, posterior.

At Thales Aquam principium rerum posuit.[3] Videbat enim materiam præcipue dispensari in humido, humidum in aqua. Consentaneum autem esse illud rerum principium ponere, in quo virtutes entium et vigores, præsertim elementa generationum et instaurationum, potissimum invenirentur. Genituram animalium humidam; etiam plantarum semina et nuclea, quamdiu vegetarent nec effœta essent, tenera et mollia. Metalla quoque liquescere et fluere, et esse tanquam terræ succos concretos, vel potius aquas quasdam minerales. Terram ipsam imbribus aut irrigatione fluviorum fœcundari et instaurari, nihilque aliud videri terram et limum, quam fæces et sedimenta aquæ. Et aërem planissime esse aquæ exspirationem atque expansionem. Quin et ignem ipsum non con-

[1] This remark Bacon may have derived from Aristotle, *Metaph.* i. 7. However, Hippo of Rhegium, or rather Hippo the atheist who is probably the same person, made earth the principle of all things, at least according to the scholiast on Hesiod's *Theogony*. (See Heinsius's Hesiod, p. 237.) Others, however, give a different account of Hippo's opinions, and it is possible that the scholiast's story was suggested to him merely by what Aristotle says of him in the third chapter of the same book.

[2] As I have remarked in the preface, reference is here made to Hesiod.

[3] Plutarch, De Plac. Philosoph. i. 3.

cipi, neque omnino durare aut ali, nisi ex humido et per humidum. Pinguedinem autem illam humidi, in qua flamma et ignis sustentantur et vivunt, videri quandam aquæ maturitatem et concoctionem. Corpus rursus et molem aquæ per universum, ut fomitem communem, dispertiri. Oceanum terræ circumfundi. Vim maximam aquarum dulcium subterraneam ; unde fontes et fluvii, qui, venarum instar, aquas per terræ et faciem et viscera deportent. At immensas vaporum et aquarum congregationes in supernis esse, utque aliam quandam aquarum universitatem, utpote a qua inferiores aquæ, atque adeo oceanus ipse, reparentur et reficiantur. Etiam ignes cœlestes existimabat aquas illas et vapores depascere ; neque enim aut sine alimento subsistere, aut aliunde ali posse ; figuram autem aquæ, quæ in ejus particulis (guttis videlicet) cernitur, eandem cum figura universi esse, rotundam nempe et sphæricam ; quin et undulationem aquæ, etiam in aëre et flamma, notari et conspici : motum denique aquæ habilem, nec torpescentem, nec præfestinum ; numerosissimam autem piscium et aquatilium generationem. Sed Anaximenes Aërem delegit, quod unum esset rerum principium.[1] Nam si moles in constituendis rerum principiis spectanda sit, videtur aër longe maxima universi spatia occupare. Nisi enim detur vacuum separatum, aut recipiatur superstitio illa de heterogenea cœlestium et sublunarium ; quicquid a globo terræ ad ultima cœli extenditur spatii, atque astrum aut meteorum non est, aërea substantia compleri videtur. Atque globi terrestris domicilium instar puncti ad cœli ambitum censetur. In æthere vere[2] ipso, quantula portio

[1] Plutarch, l. c.
[2] So in the original: probably a mistake for *verò*. — *J. S.*

in stellis conspergitur? cum in citimis sphæris singulæ conspiciantur, in ultima, licet ingens earum numerus sit, tamen præ spatiis interstellaribus exiguum quiddam spatii sidereum appareat; ut omnia tanquam in vastissimo aëris pelago natare videantur. Neque parva est ea portio aëris et spiritus, quæ in aquis et cavis terræ locis sedem et moram habet; unde aquæ fluorem suum recipiunt. Quin et extenduntur quandoque et intumescunt; terræ autem non solum porositas sua accidit, sed etiam tremores et concussiones, evidentia signa venti et aëris inclusi. Quod si media quædam natura sit propria principiorum, ut tantæ varietatis possit esse susceptiva; ea prorsus in aëre reperiri videtur. Est enim aër tanquam commune rerum vinculum, non tantum quia ubique præsto est, et succedit, et vacua possidet, sed multo magis quod videtur esse naturæ cujusdam mediæ et adiaphoræ. Hoc enim corpus illud est, quod lucem, opacitatem, omniumque colorum tincturas, et umbrarum eclipses excipit et vehit; quod sonorum etiam harmonicorum, et (quod multo majus est) articulatorum, impressiones et signaturas motu accuratissimo discriminat; quod odorum differentias, non tantum generales illas suavis et fœtidi, gravis, acuti, et similium, sed proprias et specificatas, rosæ, violæ, subit nec confundit; quod ad celebres et potentissimas illas qualitates calidi, frigidi, etiam humidi, sicci, quodammodo æquum se præbet; in quo vapores aquei, halitus pingues, spiritus salium, metallorum fumi, suspensa volant; denique in quo radii cœlestes, et arctiores rerum consensus et discordiæ, secreto commeant et obmurmurant; ut sit aër veluti chaos secundum, in quo tot rerum semina agant, errent, tentent, atque experiantur. Postremo, si vim genialem et vivificantem in

rebus consulas, quæ ad rerum principia manuducat eaque manifestet, etiam aëris potiores partes esse videntur; adeo ut aëris et spiritus et animæ vocabula usu nonnunquam confundantur. Idque merito, cum vitæ paulo adultioris (exceptis scilicet rudimentis illis vitæ in embryonibus et ovis) respiratio aliqua comes sit veluti individuus; adeo ut pisces concreta et conglaciata aquarum superficie suffocentur. Etiam ignis ipse, nisi ab aura circumfusa animetur, exstinguitur, nihilque aliud videtur quam aër attritus, irritatus, et incensus; quemadmodum aqua e contra videri possit aëris coagulum et receptus. Etiam terram perpetuo aërem exhalare, neque ut per aquam in formam aëris transitum faciat opus habere. Heraclitus vero magis acutus, sed minus credibilis, Ignem rerum principium posuit.[1] Neque enim naturam mediam, quæ maxime vaga et corruptibilis esse solet, sed naturam summam et perfectam, quæ corruptionis et alterationis terminus quidam sit, ad rerum principia constituenda quæsivit. Videbat autem maximam rerum varietatem et perturbationem in corporibus solidis et consistentibus inveniri. Talia enim corpora organica esse possunt, et veluti machinæ quædam, quæ etiam ex figura innumeras variationes nanciscuntur, qualia sunt corpora animalium et plantarum. Etiam in his ipsis, ea quoque quæ organica non sunt, tamen si acutius introspiciantur, valde esse dissimilia reperiuntur. Quanta enim dissimilitudo inter partes animalium illas ipsas, quæ vocantur similares? cerebrum, humorem crystallinum, albuginem oculi, os, membranam, cartilaginem, nervum, venam, carnem, pinguedinem, medullam, sanguinem, sperma, spiritum, chylum, reliqua? etiam inter partes vegetabilium, ra-

[1] Plutarch, l. c.

dicem, corticem, caulem, folium, florem, semen, et similia? At fossilia organica non sunt certe, sed tamen et in una specie varie commista sunt, et ad invicem admodum copiosam varietatem ostendunt. Quamobrem basis illa diversitatis entium, ampla, lata, et exporrecta, in qua tantus rerum apparatus elucescit et obversatur, constitui videtur in natura solida et consistenti. Corpora vero liquorum vis schematismi organici plane deserit. Neque enim reperitur per totam istam naturam visibilem, aut animal aut planta in corpore mere fluido. Ergo numerosissima illa varietas a natura liquida abscinditur et subducitur. Manet nihilominus varietas non parva, ut in tanta diversitate fusilium, succorum, destillatorum, et hujusmodi, manifestum est. At in aëriis et pneumaticis corporibus arctatur multo magis varietas, et obducitur promiscua quædam rerum similitudo. Certe vis illa colorum et saporum, quibus liquores quandoque distinguuntur, omnino cessat; odorum vero manet, atque aliarum nonnullarum, ita tamen ut transeant, confundantur, et minus hæreant; adeo ut in universum quo magis ad ignis naturam fiat appropinquatio tantum de varietate depereat. At postquam ad ignis naturam ventum est, ejusque rectificati et purioris, omne organum, omnisque proprietas, omnis dissimilaritas exuitur, atque natura tanquam in vertice pyramidali in unum coire videtur, atque ad terminum actionis suæ propriæ pervenisse. Itaque incensionem sive ignescentiam pacem nominavit, quia naturam componeret; generationem autem bellum, quia ad multiplex deduceret.[1] Atque ut ista ratio (qua res a varietate ad unum, et ab unitate ad varium, fluminis instar fluerent et refluerent) aliquo modo explicari

[1] Diog. Laert ix. 8

posset; ignem ei densari et rarescere placuit, ita tamen ut *rarescentia* illa versus naturam igneam, actio esset naturæ directa et progressiva; *densatio* autem veluti retrogradatio naturæ et destitutio. Utrumque fato et certis periodis (secundum summam) fieri censebat: ut mundi istius, qui volvitur, futura sit quandoque conflagratio, et deinde instauratio, atque incensionis et generationis series perpetua et successio. Ordinem autem (si quis diligenter versetur in tenui ea quæ de hoc viro atque ejus decretis ad nos pervenit memoria) diversum statuit *incensionis* et *exstinctionis*. In scala enim incensionis, nihil ab iis quæ vulgata sunt dissentiebat; ut progressus rarescentiæ et extenuationis esset a terra ad aquam, ab aqua ad aërem, ab aëre ad ignem; at non idem decursus; sed ordinem plane invertebat.[1] Ignem enim per exstinctionem terram educere asserebat, tanquam fæces quasdam atque fuligines ignis; eas deinceps uditatem concipere et colligere, unde aquæ fiat effluvium, quæ rursus aërem emittat et exspiret; ut ab igne ad terram mutatio fiat in præceps, non gradatim.

Atque hæc, aut iis meliora, cogitabant illi qui unum rerum principium statuerunt, naturam simpliciter intuiti, non contentiose. Atque laudandi sunt, quod vestem unicam Cupidini tribuerint, id quod nuditati proximum est; atque hujusmodi vestem, quæ est (ut diximus) veli cujuspiam instar, non profecto telæ spissioris. Vestem autem Cupidinis appellamus formam aliquam materiæ primæ attributam, quæ asseratur esse cum forma alicujus ex entibus secundis substantialiter homogenea. Ista autem quæ de aqua, aëre, igne, ab istis asseruntur, non firmis admodum rationibus nixa,

[1] Plutarch, l. c. Diogenes Laertius, however, does not support the statement of the text.

reprehendere non fuerit difficile; neque causa videtur cur de singulis disseramus, sed tantum in genere. Primo itaque videntur antiqui illi in inquisitione principiorum rationem non admodum acutam instituisse; sed hoc solummodo egisse, ut ex corporibus apparentibus et manifestis, quod maxime excelleret quærerent; et quod tale videbatur, principium rerum ponerent; tanquam per excellentiam, non vere[1] aut realiter. Putabant enim hujusmodi naturam dignam, quæ sola esse diceretur qualis apparet: cætera vero eandem ipsam naturam esse existimabant, licet minime secundum apparentiam; ut vel per tropum locuti, vel tanquam fascinati videantur, cum impressio fortior reliqua traxerit. At vere contemplantem, æquum se præbere oportet ad omnia, atque principia rerum statuere, quæ etiam cum minimis et rarissimis et maxime desertis quibuscunque entium conveniant, non tantum cum maximis et plurimis et vigentibus. Licet enim nos homines entia quæ maxime occurrunt maxime miremur, tamen naturæ sinus ad omnia laxatur. Quod si principium illud suum teneant non per excellentiam, sed simpliciter; videntur utique in duriorem tropum incidere; cum res plane deducatur ad æquivocum, neque de igne naturali aut naturali aëre aut aqua quod asserunt prædicari videatur, sed de igne aliquo phantastico et notionali (et sic de cæteris), qui nomen ignis retineat, definitionem abneget. Porro videntur et illi in eadem incommoda compelli, quæ assertores materiæ abstractæ subeunt. Ut enim illi materiam potentialem et phantasticam ex toto, ita et isti ex parte introducunt. Ponunt etiam materiam quoad aliquid (principium illud nempe suum) formatam et actualem; quoad reliqua tantum

[1] *vero* in the original. — *J. S.*

potentialem. Neque aliquid lucri fieri per istud genus principii unici videtur, magis quam per illud materiæ abstractæ; nisi quod habetur aliquid quod obversetur ad intellectum humanum, in quo cogitatio humana magis defigatur et acquiescat, et per quod notio principii ipsius paulo plenior sit, reliquorum omnium abstrusior et durior. Sed scilicet illa ætate *Prædicamenta* regnum non acceperant, ut potuisset principium illud naturæ abstractæ latere sub fide et tutela prædicamenti substantiæ. Itaque nemo ausus est confingere materiam aliquam plane phantasticam, sed principium statuerunt secundum sensum; aliquod ens verum; modum autem ejus dispensandi (liberius se gerentes) phantasticum. Nihil enim inveniunt, imo nec comminiscuntur, quo appetitu aut stimulo, aut qua ratione, via, aut ductu, istud principium suum a se degeneret, et rursus se recipiat.[1] At cum tanti appareant per universum contrariorum exercitus, densi, rari, calidi, frigidi, lucidi, opaci, animati, inanimati, et aliorum plurimorum quæ se invicem oppugnant, privant, perimunt; hæc omnia ab uno quopiam rei materiatæ fonte manare putare, neque tamen ullum ejus rei modum ostendere, speculationis cujusdam attonitæ videtur, et inquisitionem deserentis. Nam si de re ipsa per sensum constaret, ferendum esset, licet modus esset in obscuro; rursus si modus vi rationis erutus esset aliquis habilis et credibilis, discedendum fortasse ab apparentiis; sed minime postulandum ut iis assentiamus, quorum nec entia per sensum manifesta, neque explicationes per rationem probabiles. Præterea, si unum esset rerum principium, debuerat ejus conspici in omnibus rebus nota quædam, et tanquam partes potiores, et prædominantia nonnulla;

[1] Compare Arist. Met. i. 3.

neque inveniri principatum ullum, quod principio ex diametro opponatur. Etiam in medio collocari debuerat, ut omnibus commodius sui copiam faceret, et per ambitum se diffunderet. At horum nihil esse in illis placitis invenitur. Nam terra, quæ a principii honore separatur et excluditur, videtur suscipere et fovere naturas illis tribus principialibus oppositas, cum ad mobilitatem[1] et lucidam naturam ignis, opponat naturam quietam et opacam; ad tenuitatem et mollitiem aëris, opponat similiter naturam densam et duram; et ad humiditatem et sequacitatem aquæ, naturam siccam, rigidam, et asperam; atque ipsa quoque terra medium locum occuparit, cæteris deturbatis. Porro, si unicum esset rerum principium, debuerat et illud tum ad rerum generationem, tum ad earum dissolutionem, æquam præbere naturam. Tam enim est principii, ut res in illud solvantur, quam ut res ex illo gignantur. At hoc non fit; sed ex iis corporibus aër et ignis ad materiam generationis præbendam inepta videntur, ad eorum resolutionem excipiendam parata. At aqua contra ad generationem benigna et alma; ad resolutionem sive restitutionem magis aliena at aversa; id quod facile cerneretur, si imbres paulisper cessarent. Quin et putrefactio ipsa nullo modo res ad aquam puram et crudam redigit. Sed longe maximus error, quod constituerunt principium corruptibile et mortale. Id enim faciunt, cum principium introducunt tale, quod naturam suam in compositis deserat et deponat.

> Nam quodcunque suis mutatum finibus exit,
> Continuo hoc mors est illius, quod fuit ante.[2]

[1] *nobilitatem* in the original. A similar mistake occurs at the end of the *Thema Cœli*; which Mr. Ellis was the first to observe. — *J. S.*

[2] Lucret. iii. 518.

Verum hac ratione magis nobis opus erit statim, cum ad illam tertiam sectam, quæ plura decrevit rerum principia, sermo jam ordine devectus sit; quæ certe secta plus roboris habere videri possit, plus præjudicii certe habet. Itaque ad opiniones non secundum genus et in communi, sed singulas accedemus.

Itaque ex iis qui plura principia dixerunt, separabimus eos qui infinita asserunt. Ille enim locus de infinito ad parabolam Cœli pertinet. Verum ex antiquis Parmenides duo rerum principia, ignem et terram, dixit, sive cœlum et terram.[1] Solem enim et sidera verum ignem esse asseruit, eumque purum et limpidum,[2] non degenerem, qualis apud nos est ignis, qui tanquam Vulcanus in terram dejectus ex casu claudicat. Parmenidis vero placita instauravit seculo nostro Telesius, vir peripateticis rationibus (si aliquid illæ essent) potens et instructus, quas etiam in illos ipsos vertit; sed affirmando impeditus, et destruendo quam astruendo melior. Ipsius vero Parmenidis inventorum parca admodum et perexilis memoria. Attamen fundamenta similis opinionis plane jacta videntur in libro quem Plutarchus de primo frigido conscripsit; qui tractatus videtur ex aliquo tractatu antiquo, qui tunc temporis exstabat, jam periit, descriptus et desumptus. Habet enim non pauca et acutiora et firmiora, quam solent esse authoris ipsius qui ea vulgavit; a quibus monitus atque excitatus videtur Telesius, ut ea et studiose arriperet et strenue persequeretur in suis de

[1] This opinion, or something analogous to it, was held by many of the older physicists. (See Karsten's Parmenides, p. 230.) Beside those whom Karsten mentions, we know that Hippo Rheginus is said to have made fire and earth, or heat and cold, his first principles. (See Pseudo-Origen. Philosoph. c. 16.)

[2] Stobæus, Eclog. Phys. i. 23.

Natura Rerum commentariis. Placita autem hujus sectæ sunt hujusmodi. Primas formas ac prima entia activa, atque adeo primas substantias, calorem et frigus esse;[1] eadem nihilominus incorporea existere; sed subesse materiam passivam et potentialem, quæ corpoream molem præbeat, atque sit utriusque naturæ ex æquo susceptiva, ipsa omnis actionis expers.[2] Lucem pullulationem caloris esse,[3] sed caloris dissipati, qui coëundo multiplicatus, fit[4] robustus et sensibilis.[5] Opacitatem similiter destitutionem et confusionem naturæ radiantis ex frigore.[6] Rarum et Densum caloris et frigoris texturas et veluti telas esse; calorem vero et frigus eorum effectores et opifices, densante opus frigore et inspissante, divellente autem calore et exten-

[1] "Patet calorem et frigus agentia rerum omnium principia esse." — *De Rer. Nat.* i. 3.

[2] "Calorem frigusque incorporeum esse: rerum omnium principia tria esse, agentes naturas duas incorporeas et quæ illas suscipit corpoream unam, et omnis ipsam actionis omnisque expertam esse operationis." — *Ib.* i. 4.

"Materia æque ad calorem ac ad frigus suscipiendum apta facta est." — *Ib.* l. c.

[3] "Candor . . . nequaquam res a calore sejuncta, et alius a calore, sed si non calor ipse ipsius certe species et veluti facies est." — *Ib.* i. 1.

[4] *sit* in orig.

[5] "Patet . . . . albedinem nec eam modò quæ . . . . quod sese assidue amplificat, et quaquaversus effundit . . . . per se visilis est, et lux dicitur, sed quæ veluti torpet . . . . et non lux sed albedo dicitur . . . a solis calore in quibus spectatur rebus omnibus inditam, illiusque speciem et veluti faciem esse." — *Ib.* i. 2.

[6] The opposite to albedo, of which light is the concentration, is nigredo, and this is not ascribed by Telesius to cold, but to matter. "Nigredo omnino . . . cùm . . . calori quod albus sui naturâ visus sit assignari nequeat, minus etiam frigori, quod iis plerumque inest entibus quæ bene calida sunt, superest ut materiæ assignanda sit." — *Ib.* i. 4. Bacon's tendency throughout is to make the antagonism of heat and cold more symmetrical than it is with Telesius, who retains something of the Parmenidean view, in which heat is the active principle, and cold in a manner passive, — the relation between them being symbolised by that of the sexes.

dente.[1] Ex ejusmodi texturis indi corporibus dispositionem erga motum, vel habilem vel aversam, Raris videlicet promptam et habilem, Densis torpescentem et aversam. Itaque calorem per tenue motum excitare et peragere, frigus per densum motum compescere et sedare. Quare esse et poni quatuor naturas coessentiales atque conjugatas, easque duplices, ordinem eum quem diximus ad invicem servantes (fons enim calor et frigus, cæteræ emanationes); sed tamen perpetuo concomitantes et inseparabiles. Eas esse, Calidum, Lucidum, Rarum, Mobile. Et quatuor rursus his oppositas, Frigidum, Opacum, Densum, Immobile. Sedes vero et contignationes primæ conjugationis, in cælo, sideribus, ac præcipue in sole statui; secundæ in terra.[2] Cœlum enim e summo integroque calore et materia maxime explicata esse calidissimum, lucidissimum, tenuissimum, maxime mobile. Terram contra, ex frigore integro et irrefracto et materia maxime contracta, frigidissimam, tenebricosissimam, densissimam, penitus immobilem, ac summopere motum exhorrentem.[3]

[1] "Calor quivis . . . quæ corripit exuperatque immutare videtur, frigus scilicet ex iis, ejusque facultates conditionesque omnes crassitiem, obscuritatem, immobilitatem deturbare, et se ipsum iis propriasque facultates conditionesque omnes — tenuitatem albedinem et mobilitatem indere." — *De Rerum Nat.* i. 1. But although Telesius asserts "calorem unius modo tenuitatis opificium esse," — meaning that it produces "crassities" only per accidens, yet he nowhere says, I think, that "mobilitas" is the result of tenuity and not the direct effect of the action of heat. (See De Rer. Nat. i. 7.) On the contrary, he says, "Calorem sui naturâ mobilem, frigus contra immobile esse;" and again, that "agentes operantesque naturæ, calor nimirum frigusque moli cui sese indunt, unum prorsus fiunt." — *Ib.* i. 2.

[2] "Liceat . . . uno in sole et stellas reliquas et universum intueri cœlum" — *Ib.* i. 11. "Omnino calidus tenuis candidus mobilisque est sol." — *Ib.* i. 1. "Nec vero sol modo, sed et stellæ reliquæ omnes et cœlum itidem universum . . . ab eâdem quâ Sol naturâ et a calore omnino constitutum videtur." — *Ib.* i. 3.

"Terra contra frigida, crassa, immobilis, tenebricosaque." — *Ib.* i. 1.

[3] "Sol, cœlumque universum . . . propterea perpetuo circumvolvitur,

Summitates vero cœli naturam suam integram atque illæsam servare, diversitatem nonnullam inter se admittentes, sed a contrarii violentia et insultu penitus semotas:[1] similem per ima sive intima terræ constantiam esse; extrema tantum, ubi contrariorum sit appropinquatio et concursus, laborare, et ab invicem pati et oppugnari. Cœlum itaque tota mole et substantia calidum, et omnis contrariæ naturæ prorsus expers, sed inæqualiter; aliis partibus scilicet magis calidum, aliis minus. Stellarum enim corpus intensius calidum, interstellare remissius; quin et[2] stellis ipsis alias aliis ardentiores, et ignis magis vividi et vibrantis: ita tamen ut contraria natura frigoris, aut aliquis ejus gradus, nunquam eo penetret; recipere enim diversitatem naturæ, contrarietatem non recipere.[3] Neque vero de calore aut igne cœlestium, qui est integer et nativus, ex igne communi judicium omnino fieri. Ignem enim nostrum extra locum suum, trepidum, contrariis circumfusum, indigum, et stipem alimenti, ut conservetur, emendicantem, et fugientem;[4] at in

quod ipsius opifex calor circulari assidue commotus motu, molem cui penitus infixus est . . . secum agit. Sic itidem et Terra immobilis in sublimi permanet . . . quod frigus a quo constituta est . . . nullo moveri potest motu." — *De Rer. Nat.* i. 2.

[1] "Sol modo terraque . . nec fieri unquam nec unquam immutari, entia vero reliqua assidue fieri assidueque immutari corrumpique videntur. Patet entia reliqua omnia a sole terram oppugnante invertenteque (repugnante et contra agente terrâ) effecta esse." — *Ib.* i. 11.

[2] So in the original. We should apparently read *ex* for *et*. — *J. S.*

[3] "Una terra excepta, reliquorum entium nullum prorsus a frigore, sed . . . a calore constituta sunt omnia. . . . Non sensus modò, ratio, omnium fere veterum physicorum consensus, sed divinæ etiam literæ cœlum calidum testantur. . . Nullum porro, nec infima nec suprema cœli portio ad nos calorem, nullamque emittere videtur lucem, quod in longe utrâque tenuissimâ perexilis inest calor." — *De Rer. Nat.* i. 3.

[4] "Flammas, quæ nutrimento absumpto perierunt, in non ens abiisse existimare non contingit, in summam proindeque et invisilem tenuitatem

cœlo vero locatum, ab impetu alicujus contrarii disjunctum, constantem, ex se et similibus conservatum, et proprias operationes libere et absque molestia peragentem. Item cœlum omni parte lucidum, sed secundum magis et minus. Cum enim sint ex stellis notis et numeratis quæ nisi cœlo sereno conspici non possint, atque in galaxia sint nodi minutarum stellarum quæ albedinem quandam conjunctæ, non corpus lucidum distinctæ repræsentent; nemini dubium esse posse, quin et sint stellæ complures quoad nos invisibiles; atque adeo universum cœli corpus luce præditum sit, licet fulgore non tam robusto et vibrante, nec radiis tam confertis et constipatis, ut tanta spatia distantiarum vincere queat, et ad nostrum aspectum pervenire.[1] Ita rursus cœlum universum ex substantia tenui et rara, nil in ea contrusum, nil illibenter compactum, sed tamen alia parte materiam magis explicatam, alia minus explicatam sortiri.[2] Postremo, motum cœli eum inveniri qui rei maxime mobili competat, conversionis nimirum sive rotationis. Motus enim circularis absque termino est, et sui gratia. Motus in linea recta, ad terminum et ad aliquid, et tanquam ut quiescat.[3] Ita-

actas, et ab insidente calore sursum elatas esse, existimandum est." — *De Rer. Nat.* i. 1.

[1] "Eadem illius (solis) stellarumque et cœli universi natura conditiones reliquæ omnes, at (the text is *aut*) hujus vires, conditionesque reliquæ, multæ robustiores nobisque manifestioresque sunt." — *Ib.* i. 11. "Lactea . . via . . quin cœli portio sit paululo quid quam reliquum est magis conspissata et propterea splendidior facta nulli dubium esse potest."— *Ib.* i. 3. Observe that nothing is said of stars in the Milky Way. "Ab ipsis (supremis et infimis cœli portionibus) lucem quandam emanare, et quæ . . . quibusdam animalium generibus percipiatur, quæ longissima noctu conficiunt itinera declarant." — *Ib.* l. c.

[2] "Summâ universum (cœlum) tenuitate summâque donatum esse albedine, lux . . . manifeste declarat." — *Ib.* i. 3.

[3] Telesius gives no other reason than the following. "Sol, cœlumque universum propterea perpetuo circumvolvitur, quod ipsius opifex calor

que universum cœlum motu circulari ferri, nec ullam ejus partem hujus motus expertem esse; sed tamen quemadmodum et in calore et in luce et raritate cœli versatur inæqualitas, ita et in motu eandem notari; adeoque magis insigniter, quia observationem humanam magis lacessit et sustinet, ut etiam calculos pati possit.[1] Motum autem orbicularem et incitatione differre posse et latione; incitatione,[2] ut sit celerior aut tardior; latione, ut sit in circulo perfecto, aut aliquid habeat spiræ neque se plane restituat ad eundem terminum (nam linea spiralis ex circulo et recta composita est). Itaque hæc ipsa cœlo accidere, varietatem nempe incitationis, et deflexionem a restitutione, sive spiralitatem.[3] Nam et stellæ inerrantes et planetæ impariter properant; et planetæ evidenter a tropico in tropicum deflectunt; atque quo sublimiora cœlestia sunt, eo et majorem incitationem sortiuntur, et propiorem spiram. Nam si phænomena simpliciter atque ut conspiciuntur accipiantur, et ponatur motus diurnus unus naturalis et simplex in cœlestibus, et formositas illa mathematica (ut motus reducantur ad circulos perfectos) contemnatur, et recipiantur lineæ spirales, et contrarietates illæ

circulari assidue commotus motu molem cui penitus infixus est . . secum agit." — *De Rer. Nat.* i. 2. The motions of the heavens and their construction he afterwards seeks to explain on teleological grounds which Bacon does not notice, but which are a prominent part of Telesius's system. See *De Rer. Nat.* i. 9. 10., and comp. the physiological speculations in the sixth book.

[1] Telesius does not attempt to connect the inequality of heat with that of motion, declaring — "non modum, quo qualis est, constructus sit mundus, sed cur ita construendus fuerit, et cur quibus cœlum movetur motibus iis moveri oportuerit, inquirendum esse." — *Ib.* i. 9.

[2] In the original *et* is repeated before *incitatione*. — *J. S.*

[3] Telesius says that the special hypotheses of astronomy are foreign to his purpose; his leaning is however in favour of the doctrine here ascribed to him, and which we know from Tassoni was adopted by his disciples. See the preface to the *Descriptio Globi Intellect.* and *De Rer. Nat.*, ubi modo.

motuum in consecutione ab oriente in occidentem (quem vocant primi mobilis), et rursus ab occidente in orientem (quem vocant motum proprium planetarum) redigantur in unum, salvando differentiam temporis in restitutione per præfestinationem et derelictionem, et diversam politatem zodiaci per spiras; manifestum est, hoc quod diximus evenire: exempli gratia, ut luna, quæ est planetarum infima, incedat et tardissime et per spiras maxime raras et hiantes. Atque talis quædam naturâ portionis illius cœli quæ fit (propter distantiam a contrario) firma et perpetua, huic sectæ videri possit. Utrum vero veteres terminos servarit Telesius, ut talia esse putaret quæcunque supra lunam collocantur, cum luna ipsa, an altius vim inimicam adscendere posse, perspicue non ponit. At terræ (quæ est oppositæ naturæ contignatio et sedes) portionem itidem maximam intemeratam et inconcussam statuit, et quo cœlestia non penetrent. Eam[1] vero qualis sit, non esse cur inquiratur, ait. Sat esse ut quatuor illis naturis, frigiditate, opacitate, densitate, et quiete, iisque absolutis et nullatenus imminutis, dotata judicetur. Partem autem terræ versus superficiem ejus, veluti quendam corticem aut incrustationem, generationi rerum assignat;[2] omniaque entia quæ nobis quovis modo innotuerunt, etiam ponderosissima, durissima, et altissime demersa, metalla, lapides, mare, ex terra per calorem cœli aliqua ex parte versa et subacta, et quæ nonnihil caloris, radiationis, tenuitatis, et mobilitatiis jam conceperit, et denique ex

[1] So in the original; a mistake apparently for *ea*. — *J. S.*

[2] "Extrema tantum utriusque (cœli et terræ) portio (siquidem et extremi hujus cœli pars ulla in aliud unquam agitur ens) in entia, in quæ assiduè agi videtur, immutari possit: reliqua utriusque moles in propriâ servari queat naturâ." — *De Rer. Nat.* i. 10.

media inter solem et terram puram natura participet, consistere.[1] Itaque necesse est, ut terra illa pura infra profundissima maris, minerarum,[2] et omnis generati deprimatur; et a terra illa pura usque ad lunam, aut altiora fortasse, media quædam natura ex temperamentis et refractionibus cœli et terræ collocetur. Postquam autem interiora utriusque regni satis muniisset, expeditionem et bellum molitur. Nam in spatiis illis intra extima cœli et intima terræ, omnem tumultum et conflictum et tartarismum inveniri, ut fit in imperiis, in quibus illud usuvenit, ut fines incursionibus et violentiis infestentur, dum interiores provinciæ secura pace fruuntur. Has itaque naturas et earum concretiones, sese assidue generandi et multiplicandi et quaquaversus offundendi, et molem materiæ universam occupandi, et sese mutuo oppugnandi et invadendi, et propriis se sedibus deturbandi et ejiciendi, et sese in iis constituendi, præterea et alterius naturæ vim et actiones, et proprias etiam, percipiendi et prehendendi, et ex hujusmodi perceptione se movendi et accommodandi, appetitum et facultatem habere; atque ex ista decertatione, omnium entium atque omnis actionis et virtutis varietatem deduci.[3] Videtur tamen alicubi, licet titubanter et strictim, aliquid dotis materiæ im-

[1] "Non perpetuo agit Sol, sed agere interdum cessat, et dum agit non iisdem perpetuo sed aliis atque aliis agit viribus: . . . non quotidiano tantùm . . . agit calore. . . , sed eo insuper . . . quem jam diu terris indidit atque indit. . . . . Robustior factus solis calor, strenuè supremam terræ portionem emollit laxatque, et strenuè præexistentem ei calorem fovet . . . . . materiam nactus longe minus repugnantem." — *De Rer. Nat.* i. 13.

[2] *mineranem* in the original. — *J. S.*

[3] "A sole porro terram oppugnante, ejusque naturam et conditiones reliquas deturbante, suasque indente, tot interea adeoque diversa constituuntur entia: . . . Solis terræque vires longè amplissimæ sunt . . . et dum alteræ alteras oppugnant et ad internecionem agunt, nequaquam

pertiri; primo ut non augeatur nec minuatur per formas et activa entia, sed summa universali constet:[1] deinde ut motus gravitatis sive descensus ad illam referatur;[2] etiam quiddam de nigredine materiæ injicit.[3] Illud autem perspicue; calorem et frigus eadem vi et copia, in materia explicata vires remittere, in complicata intendere, cum mensuram non suam sed materiæ impleant.[4] Modum vero excogitat atque explicat Telesius, quo ex hoc certamine et lucta induci atque expediri possit tam fœcunda et multiplex entium generatio. Ac primo cavet terræ, inferiori scilicet principio, ac ostendit quid in causa sit cur a sole terra jampridem destructa et absorpta non sit, nec in futurum esse possit.[5] Caput huic rei distantiam ponit terræ a stellis fixis immensam, a sole ipso satis mag-

stertunt nihilque contra agunt alteræ, sed strenuè repugnant, et dum non penitus pereunt contrariæ et ipsæ oppugnant oblæduntque et imminuunt." —*De Rer. Nat.* i. 14.

[1] "Materiæ molem neque minui neque augeri unquam." — *Ib.* i. 5.

[2] "Communis ipsorum omnium (crassiorum entium) delapsus . . . moli assignandus est." — *Ib.* i. 4. The reason being, that it cannot be assigned to heat which tends upwards, nor to cold which tends to immobility.

[3] See above, p. 311. n. 6. [The original has *ingredine*. — *J. S.*]

[4] "Quam . . . molis portionem sortitus est calor penitus illam is subiit universam. . . . Calori frigorique illam ut libet effingendi disponendique, non et efficiendi et veluti novam creandi, donata est vis." — *Ib.* i. 5.

[5] The tenth chapter of Telesius's first book is teleological. "Summa Dei bonitas . . . ens nullum . . . perdi velit." For the preservation of the universe and the balance of heat and cold, the earth is put in the middle point of the heavens. The heavens and the earth are both spherical — the former according to the free and uniform motion of the different orbs, and the latter that half of it may always be exposed to the sun's influence. If the earth were larger and not in the centre of the universe, the power of cold would predominate and destroy the lower part of heaven. For the security of the earth, — the density and heat of the heavens are not uniform, and both sun and stars are at a great distance; and the oblique and unequal motion of the sun prevents his remaining too long over any part of the earth's surface. All this agrees tolerably well with Bacon's account of it, but to his fifth reason I do not find anything corresponding in the text.

nam, et qualis esse debeat, bene mensuratam. Secundo, declinationem radiorum solis a perpendiculo, habito respectu ad partes terræ diversas; quod videlicet supra majorem partem terræ sol nunquam sit in vertice, aut incidentia radiorum perpendicularis; adeo ut universum terræ globum vigore aliquo caloris notabili nunquam occupet. Tertio, obliquitatem motus solis in transcursu per zodiacum, habito respectu ad easdem terræ partes; unde calor solis in qualicunque vigore non assiduo ingeminatur, sed per intervalla majora redit. Quarto, celeritatem solis respectu motus diurni, qui tantum ambitum tam exiguo temporis spatio conficit; unde minor mora caloris, neque momentum aliquod temporis in quo calor constet. Quinto, continuationem corporum inter solem et terram, quod sol non per vacuum integras caloris demittat vires, sed per tot corpora renitentia permeans, et cum singulis satagens et dimicans, in immensum langueat et enervetur; tanto magis quod quo longius procedat atque debilior evadat, eo corpora inveniat magis inobsequentia; maxime omnium, postquam ad terræ superficiem ventum est, ubi videtur non solum renitentia, sed plane quædam repulsio. Processum vero immutationis talem asserit. Bellum plane inexpiabile atque internecivum esse; neque contrarias istas naturas ullo symbolo convenire, neque per tertiam, præterquam hylen. Itaque utramque naturam hoc ipsum appetere, niti, contendere, ut alteram plane perdat, seque solam et suam materiæ indat; ut sit solis opus (quod perspicue et sæpe dicit) plane terram vertere in solem; et vicissim opus terræ, solem vertere in terram;[1] neque hoc officere quin om-

[1] "Calorem in terram sol emittens . . . quas ejus portiones exuperat, . . . ipsum . . . in ignem, ipsum scilicet in cœlum, solemque agit in

nia certo ordine, definitis temporibus, et justis mensuris fiant; atque actio quæque cursu debito incipiat, moliatur, vigeat, langueat, cesset. Quod tamen per leges fœderis aut concordiæ ullas non fieri, sed omnino per impotentiam: omne enim plus et minus in virtute et actione, non ab intensionis moderamine (quæ integrum quiddam concupiscit), sed ab oppositæ naturæ ictu et fræno esse. Operationis diversitatem et multiplicitatem atque etiam perplexitatem omnino propter unum ex tribus istis evenire; vim caloris, dispositionem materiæ, modum subactionis; quæ tamen tria nexu quodam inter se implicantur, atque sibi ipsis concausæ sunt. Calorem ipsum, vi, copia, mora, medio, successione differre: successionem vero ipsam in plurimis variari; accedentia, recedentia; sive intensione, remissione; saltu, gradu, reditu; sive repetitione per majora aut minora intervalla; atque hujusmodi alterationibus. Calores itaque prorsus vi et natura longe diversissimos esse, prout puriores vel impuriores, habita ratione ad primum fontem (solem videlicet), facti sint. Neque calorem omnem calorem fovere; sed postquam gradibus bene multis ad invicem distent, se mutuo non minus quam frigora perimere ac perdere, et proprias actiones agere, et alterius actionibus adversari atque opponi; ut minores calores ad multo majores constituat Telesius tanquam proditores et perfugas, et cum frigore conspirantes.[1] Itaque vividum illum calorem qui in igne est et vibratur, exilem

ipsum. . . . Si integrum, robustumque, et diuturnum adsit frigus, quæ corripit . . . ipsam in terram ea acturum sit omnia." — *De Rer. Nat.* i. 1.

[1] "Quis enim calidorum entium longe diversissimas esse vires, et calida quæ sunt, sese mutuo aversari aufugereque, et mutuo sese oppugnare interimereque, calores scilicet diversis donatos viribus, sese mutuo oppugnare corrumpereque non percipit?" — *Ib.* i. 13.

illum calorem qui in aqua serpit omnino interimere; atque similiter calorem præternaturalem humorum putridorum, in corpore humano, calorem naturalem suffocare et exstinguere. Copiam vero caloris plurimum interesse, manifestius esse quam ut explicatione egeat. Neque enim unam aut alteram ignis prunam æque vehementer ac multas coacervatas calefacere; maxime autem insigniter copiæ caloris effectum demonstrari in multiplicatione caloris solis, per reflexionem radiorum; numerus enim radiorum conduplicatur per reflexionem simplicem, multiplicatur per variam. Copiæ caloris vero debet adscribi vel addi et unio, quod etiam obliquitate et perpendiculo radiorum optime ostenditur, cum quo propius et ad acutiores angulos radius directus et reflexus coëat, eo validiorem caloris ictum jaciat. Quin et sol ipse, cum inter majores illos et robustiores stellarum fixarum ignes, Regulum, Caniculum, Spicam, versatur, valentiores fervores efflat. Moram vero caloris evidentissime maximi momenti operationem esse; cum omnes virtutes naturales tempora colant, observent; ut ad vires actuandas tempus requiratur nonnullum, ad roborandas bene multum. Itaque moram caloris calorem æqualem in progressivam et inæqualem convertere, quia calor et antecedens et subsequens simul conjugantur; id et in fervoribus autumnalibus, quia fervoribus solstitialibus, et in horis æstivis pomeridianis, quia horis ipsis meridianis ardentiores sentiuntur, manifestum esse; etiam in frigidioribus regionibus debilitatem caloris, mora et longitudine dierum æstivis temporibus quandoque compensari. At medii potentiam et efficaciam in calore deferendo insignem esse. Hinc enim tempestatum temperiem magnopere variam, ut cœlum indicibili in-

constantia per dies æstivos algidum nonnihil, per dies hiemales sudum quandoque inveniatur; sole interim iter suum et spatia sua constanter et legitime servante. Etiam segetes et uvas flantibus austris et cœlo nubiloso magis mutari. Atque omnem cœli secundum varias annorum revolutiones dispositionem et excretionem, aliquando pestilentem et morbidam, aliquando salubrem et amicam, hinc causam et originem sumere; medio scilicet aëre variante, quæ dispositionem ex ipsa vicissitudine et alteratione tempestatum diversam, longa fortasse serie, colligit. Successionis vero caloris atque ordinis quo calor calorem consequitur, ut multiplicem rationem, ita summam virtutem esse. Neque solem tam numerosam et prolificam generationem educere potuisse, nisi corporis solis moventis configuratio versus terram et terræ partes plurimæ inæqualitatis et variationis particeps esset. Nam et circulariter movetur sol, et rapide et ex obliquo, et se retexit, ut et absens sit et præsens, et propior et remotior, et magis ex perpendiculo et magis ex obliquo, et citius rediens et tardius, neque ullo temporis momento calor emanans a sole sibi constet, neque brevi intervallo usquam (nisi sub ipsis tropicis) se restituat; ut tanta variatio generantis cum tanta varietate generati optime conveniat. Cui addi posse medii sive vehiculi naturam diversissimam. Cætera quoque quæ de inæqualitate et gradibus caloris unici dicta sunt, posse ad vicissitudines et varietates successionis in caloribus diversis referri. Itaque Aristotelem non male generationem et corruptionem rerum obliquæ viæ solis attribuisse, eamque ut efficientem causam earum constituisse,[1] si libidine pronun-

[1] "Efficientem rerum causam . . . perperam (ab Aristotele) obliquæ solis lationi assignatam. Obliqua latio non aliud agit quicquam, sed tantum ut Sol magis minusve directus fiat." — *De Rer. Nat.* iv. 2.

tiandi et arbitrum naturæ se gerendi, et res ad placitum suum distinguendi et concinnandi, recte inventum non corrupisset. Illum enim et generationem et corruptionem (quæ nunquam prorsus privativa, sed generationis alterius prægnans est) inæqualitati caloris solis secundum totum, hoc est, accedentiæ et recedentiæ solis conjunctim, non generationem accedentiæ, corruptionem recedentiæ divisim, assignare debuisse; quod pinguiter et ex vulgi fere judicio fecit.[1] Quod si cui mirum videatur, generationem rerum soli attribui; cum sol ignis esse asseratur et supponatur, ignis autem nil generet; id leviter objici. Somnium enim plane esse illud de heterogenia calorum solis et ignis. Infinitas enim esse operationes, in quibus actio solis et actio ignis conveniant; ut in maturatione fructuum, conservatione plantarum tenerarum et clementiæ cœli assuetarum in regionibus frigidis, exclusione ovorum, restitutione urinarum ad claritatem (calorem enim solis et animalis conjungimus), resuscitatione animalculorum frigore obrigentium, evocatione rorum[2] et vaporum, et id genus.[3] Sed nihilominus ignem nostrum malum mimum esse, nec solis actiones bene imitari aut prope attingere; cum solis calor tribus dotatus sit proprietatibus, quas ignis communis ægre ullo artificio repræsentare possit.[4] Primo, quod sit ob distantiam gradu ipso minor et blandior; hoc vero ejusmodi esse, ut

[1] "Solem accedentem generationis causam non esse, nec recedentem corruptionis, ut Aristoteli placet."

[2] *eorum* in the original. — *J. S.*

[3] "Igneum calorem ab animalium solisque calore diversum non esse." — *De Rer. Nat.* vi. 20. Telesius gives some instances in proof of this assertion: Bacon's however are for the most part his own.

[4] "Non igitur ad animalium plantarumque generationem ineptus est ignis, quod ejus calor ab animalium et a cœlesti calore diversus sit, sed quod nimis est vehemens." — *Ib.* vi. 20.

aliquo modo æquiparari possit; caloris enim talis modus magis incognitus est quam imparabilis. Secundo, quod per tot et talia media fluens et gliscens dissimularem quandam et generativam vim mutuetur et obtineat; maxime vero quod tam regulari inæqualitate augeatur, minuatur, accedat, recedat, nunquam vero subsultorie aut præcipitanter sibi succedat. Quæ duo postrema ab igne fere sunt inimitabilia, licet industria perspicaci et perpensa res provehi possit. Atque hujusmodi quædam de diversitate calorum a Telesio dicuntur.

Frigidi autem, contrarii nempe principii, atque dispensationis ejus vix meminit;[1] nisi forte quæ de dispositione materiæ jam secundo loco dicentur, ea huic rei satisfacere posse putaverit; quod tamen facere non debuit, quandoquidem frigus nullo modo privationem caloris, sed omnino principium activum, caloris æmulum et tanquam competitorem, videri voluit. Quæ autem de materiæ dispositione disseruit, eo pertinent ut ostendant quomodo materia a calore patiatur et subigatur et vertatur, missa frigoris mentione aut cura. De frigore autem (nos enim in omnium inventis summa cum fide, et tanquam faventes, versamur) hujusmodi quædam dicere potuit. Sedem frigidi immotam et fixam ad structuram caloris mobilem et versatilem optime convenire; tanquam incudem ad malleum. Nam si utrumque principium varietatem et alterationem habuisset, genuissent proculdubio entia horaria et momentanea. Etiam immensas regiones calidi

[1] "Nostrorum entium nullum prorsus a frigore, sed eorum quodvis a calore constitutum est, et vel suprema terræ portio in calidum acta est ens." —*De Rer. Nat.* i. 16.; a passage which suggests the remark I have already made, that Telesius did not regard heat and cold as equally active principles. Compare ii. 23. throughout.

(cœlum scilicet), compacta natura globi terræ et circumjacentium nonnihil compensari; cum non spatia, sed copia materiæ in spatiis spectetur; frigidi vero naturam, virtutes, et rationes, merito aut silentio præteriri aut brevi sermone transmitti debere, cum nil certi et explorati de eo haberi possit per experientiam. Habemus enim ignem communem, tanquam solis vicarium, qui caloris naturam manifestet. At frigidi telluris nulla est substitutio, quæ in manu hominis sit et adhibeatur præsto ad experimentum. Etenim illos horrores et rigores frigidi qui ex globo et ambitu terræ hiemalibus temporibus et in regionibus frigidissimis exspirant in aërem, tepores plane et balnea esse, præ natura primi frigidi in visceribus terræ inclusi; ut frigus illud cujus homines sensum et potestatem habeant, simile quiddam sit, ac si calorem nullum alium haberent, præter eum qui a sole æstivis diebus et in calidis regionibus emanat; qui ad ignes fornacis ardentis collatus, refrigerium quoddam censeri possit. Sed in iis quæ subdititia sunt minus morandum. Videndum igitur deinceps, qualia sint ea quæ a Telesio dicuntur circa dispositionem materiæ, in quam calor agat; cujus ea est vis, ut actionem ipsam caloris promoveat, impediat, immutet. Ejus ratio quadruplex. Prima differentia sumitur ex calore præinexistente aut non præinexistente.[1] Secunda, ex copia aut paucitate materiæ.[2] Tertia, ex gradibus subactionis.[3] Quarta, ex clausura vel apertura corporis subacti.[4] Quod ad primam attinet, sup-

[1] See above [p. 317. note 1.]

[2] "Materiæ dispositiones . . . juxta expansionis constrictionisque diversitatem expendendas esse." — *De Rer. Nat.* i. 19.

[3] Ib. i. 20. passim.

[4] This difference is not stated by Telesius, though it may be presumed that it had occurred to him.

ponit Telesius in omnibus entibus quæ nobis cognita sunt subesse atque latitare calorem nonnullum, licet ad tactum minime deprehendatur, qui calor cum novo aut superveniente calore conjungitur; quin et ipse ab eodem adventitio calore ad actiones suas peragendas etiam in proprio modulo excitatur atque incenditur. Hujus rei argumentum esse insigne, quod nullum scilicet sit ex entibus, non metallum, non lapis, non aqua, non aër, quod non ex attactu atque etiam ab admotione ignis aut corporis calidi calescat.[1] Quod factum iri verisimile non est, nisi calor præinexistens et latens præparatio quædam esset ad calorem novum et manifestum. Etiam illud magis et minus, nempe facilitatem aut tarditatem in calore concipiendo, quod in entibus invenitur, secundum modum caloris præinexistentis competere. Aërem enim parvo calore tepescere, atque eo qui in corpore aquæ non percipiatur sed sensum fugiat. Etiam aquam citius tepescere, quam lapidem aut metallum aut vitrum. Nam quod aliquod ex istis, metallum scilicet aut lapis, citius tepescere videatur quam aqua, id tantum in superficie fieri, non in profundo; quia corpora consistentia minus communicabilia sunt in partibus suis, quam liquida. Itaque extima metalli citius calefieri quam extima aquæ, universam autem molem tardius. Secunda differentia ponitur in coacerva-

[1] The notion of heat latent in all bodies, inexistens calor, is frequent in Telesius; as in the passage quoted above, p. 317., from the thirteenth chapter of the first book, and as in the nineteenth, where it is said, "Comprimendi (calori) nimirum ut cedant flectanturque et fluant . . . . . inexistens præstat calor qui, si non propriâ vi, at comprimentis ope usus, illam commovet;" where illam, I believe, refers to the words "materiæ expansio," contained in the clause I have omitted. But I have not found the argument by which Bacon goes on to support this doctrine, which would naturally have occurred in the twenty-third chapter of the second book, in which Telesius seeks to show that all the elements except earth bear traces of having been generated by heat.

tione et exporrectione materiæ. Ea si densa fuerit, fit ut caloris vires magis uniantur, et per unionem magis augeantur et intendantur; contra, si laxior fuerit, ut magis disgregentur, et per disgregationem magis minuantur et enerventur. Itaque fortiorem esse calorem metallorum ignitorum quam aquæ ferventis, etiam quam flammæ ipsius, nisi quod flamma per tenuitatem magis subintret. Nam flammam carbonum sive lignorum, nisi flatu excitetur, ut per motum facilius impellatur et penetret, non admodum furere; quin et nonnullas flammas (qualis est spiritus vini inflammati, præsertim in exigua quantitate et dispersa) adeo lenis caloris esse, ut ad manum fere toleretur. Tertia differentia, quæ sumitur ex subactione materiæ, multiplex est; gradus enim subactionis memorantur ab eo quasi septem;[1] quorum primus est Lentor, qui est dispositio materiæ exhibens corpus ad majorem violentiam nonnihil obsequens, et compressionis et præcipue extensionis patiens, flexibile[2] denique aut ductile. Secundus, Mollities, cum majore violentia nil opus est, sed corpus etiam levi impulsione atque ad tactum ipsum sive manum cedit, absque evidenti renitentia. Tertia, Viscositas sive Tenacitas, quæ est principium quoddam fluoris. Videtur enim corpus viscosum ad contactum et complexum alterius corporis incipere fluere et continuari, nec se ipso finiri, licet sponte et ex sese non fluat;

[1] Only six. "Insignes crassitiei ad tenuitatem progredientes immutationes, lentorem, mollitiem, viscositatem, fluorem, vaporem esse." After describing these five degrees, Telesius goes on at once to say: "Sextum verum atque extremum (spatium occupat) tenuitas, quæ scilicet non tactum modo sed quantumvis in se ipsa coacta visum etiam, quod vapores non faciunt, penitus lateat et quantavis facta lucem nihil imminuit fœdatve usquam, ut a vaporibus sejungenda ideo sit et cœlo ex universo inesse videtur."— *De Rer. Nat.* i. 20. Whence it seems that air is included among the vapores.

[2] *fluxibile* in the original. — *J. S.*

fluidum enim sui sequax est, viscosum alterius magis. Quarta, ipse fluor, cum corpus spiritus interioris particeps in motu versatur libens, et seipsum sequitur, atque ægre definitur aut consistit. Quinta, Vapor, cum corpus attenuatur in intactile, quod etiam majore cum agilitate et mobilitate cedit, fluit, undulat, trepidat. Sexta, Halitus, qui vapor est quidam magis coctus et maturus, et ad igneam naturam recipiendam subactus. Septima, aër ipse; aërem autem contendit Telesius omnino calore nativo, neque eo parvo aut impotenti, præditum esse; quod etiam in frigidissimis regionibus aër nunquam congelatur aut concrescit. Etiam illud evidenti indicio esse, aërem in natura propria calidum esse, quod omnis aër clausus, et ab universitate aëris divulsus, et sibi permissus, teporem manifeste colligit; ut in lana et rebus fibrosis. Etiam in locis clausis et angustis, aërem ad respirationem sentiri quodam modo suffocativum, quod a calido est. Atque hæc propterea fieri, quod aër clausus sua natura uti incipiat, cum aër foras et sub dio refrigeretur a frigore, quod globus terræ perpetuo emittit et efflat. Quin etiam aërem nostrum communem tenui quadam cœlestium dote insigniri, cum habeat nonnihil in se lucis; quod ex visu animalium, quæ noctu et in locis obscuris cernere possunt, ostenditur.[1] Atque talis est Telesio dispositionis materiæ series, in mediis videlicet; siquidem extrema,

[1] That certain animals can see at night is with Telesius a proof that the apparently obscure parts of the heavens — the highest and lowest, — give out a perceptible amount of light, not that the air is itself luminous, — unless the "infima cœli portio" be understood to mean our atmosphere. (See De Rer. Nat. i. 3.) It is remarkable that Bacon omits Telesius's chief argument in favour of the opinion that the air is generated by and contains heat, namely that it partakes in some measure of the circular motion which the heavens derive from the pure and effectual heat by which they are constituted. The natural motion of the air is made manifest according to Telesius by the sound heard when a shell is put to the ear.

videlicet ex altera parte corpora dura et rigida, ex altera ignis ipse, tanquam termini mediorum non recensentur. Sed præter hosce gradus simplices, magnam aucupatur diversitatem in dispositione materiæ ex corpore similari et dissimilari; cum scilicet portiones materiæ in uno corpore compositæ et coadunatæ, vel ad unum ex gradibus supra-dictis æqualiter referri possunt, vel ad diversa impariter.[1] Longe enim maximam inde sequi in operatione caloris differentiam. Itaque quartam illam differentiam necessario adhiberi ex natura ac etiam positura corporis in quod calor agat, clausa, aut porosa et aperta. Quando enim in aperta et exposita operatur calor, operatur seriatim et per singula, attenuando et simul educendo et separando. Cum vero in occlusa et compacta, operatur secundum totum et secundum massam, nulla facta jactura caloris, sed calore novo et vetere se conjungentibus et plane conspirantibus; unde fit ut potentiores et magis intrinsecas et exquisitas alterationes et subactiones conficiat. Verum de hoc plura mox dicentur, cum de modo subactionis disseremus. Sed interim satagit et æstuat Telesius, et miris modis implicatur,[2] ut expediat modum divortii et separationis qualitatum suarum primarum connaturalium, caloris, lucis, tenuitatis, et mobilitatis, ac quaternionis oppositæ, prout corporibus accidunt: cum corpora alia inveniantur calida, aut ad calorem optime præparata, sed eadem inveniantur quoque densa, quieta, nigra; alia tenuia, mobilia, lucida sive

[1] "Perpauca quædam similari e terrâ et uno eodemque a calore universa effecta sunt . . . sed e terrâ pleraque, quæ aliis sui partibus et non magnis iis tenuis laxiorque, aliis vero crassior est densiorque."—*De Rer. Nat.* i. 15.

[2] See De Rer. Nat. i. 16. The general purport of his explanation is, that the action of heat is mingled with and controlled by that of cold.

alba, sed tamen frigida; et similiter de cæteris; una quapiam qualitate in rebus existente, reliquis non competentibus; alia vero duabus ex istis naturis participent, duabus contra priventur, varia admodum permutatione et consortio. Qua in parte Telesius non admodum feliciter perfungitur, sed more adversariorum suorum se gerit; qui cum prius opinantur quam experiuntur, ubi ad res particulares ventum est, ingenio et rebus abutuntur, atque tam ingenium quam res misere lacerant et torquent; et tamen alacres et (si ipsis credas) victores suo sensu utcunque abundant. Concludit autem rem per desperationem et votum, illud significans, licet et caloris vis et copia, et materiæ dispositio, crasso modo et secundum summas distingui et terminari possint; tamen exactas et accuratas eorum rationes, et distinctos et tanquam mensuratos modos, extra inquisitionis humanæ aditus sepositos esse; ita tamen, ut (quo modo inter impossibilia) diversitas dispositionis materiæ, melius quam caloris vires et gradus, perspici possit; atque nihilominus in his ipsis (si qua fata sinant) humanas et scientiæ et potentiæ fastigium et culmen esse. Postquam autem desperationem plane professus esset, tamen in vota precesque non cessat. Ita enim dixit: *Qui porro calor vel quantus, hoc est, quod caloris robur et quæ ejus copia, quam terram et quæ entia in qualia invertat, minime inquirendum videtur, ut quod homini nulla (ut nobis videtur) innotescere queat ratione. Qui enim vel caloris vires et calorem ipsum veluti in gradus partiri, vel materiæ cui inditus est copiam quantitatemque distincte percipere et certis determinatisque caloris viribus copiæque certam materiæ quantitatem dispositionemque certasque actiones, aut contra,*[1] *certæ*

[1] *centra* in original.

materiæ quantitati certisque actionibus certam determinatamque caloris copiam, assignare liceat? Utinam id otio fruentes et perspicaciore prædíti ingenio, et quibus in summa tranquillitate rerum naturam perscrutari licuerit, assequantur: ut homines non omnium modo scientes, sed omnium fere potentes fiant![1] honestius paulo quam solent ejus adversarii, qui quicquid artes quas ipsi pepererunt non assequuntur, id ex arte omnino impossibile statuunt, ut nulla ars damnari possit, cum ipsa et agat et judicet. Restat tertium quod erat, subactionis videlicet modus. Hoc triplici dogmate absolvit Telesius. Primum est, id quod antea a nobis obiter est notatum, nullam prorsus symbolizationem intelligi (ut in Peripateticorum doctrina), per quam res tanquam concordia quadam foveantur et conspirent. Omnem enim generationem, atque adeo omnem effectum in corpore naturali, victoria et prædominantia, non pacto aut fœdere transigi. Id quod novum non est, cum etiam Aristoteles in doctrina Empedoclis hoc ipsum notaverit.[2] Quod scilicet cum Empedocles Litem et Amicitiam, rerum principia efficientia statuisset, tamen in explicationibus suis causarum, Inimicitia fere utatur, alterius

[1] This quotation is inaccurate. "Qui porro calor, vel quantus, quod nimirum caloris robur et quæ ejus copia, quam terram et quæ entia in qualia invertat, minime inquirendum videtur, ut quod homini nulla, ut nobis videtur, innotescere queat ratione. Qui enim vel caloris vires, et calorem ipsum veluti in gradus partiri vel materiæ cui inditus est copiam quantitatemque distinctè percipere, et certis determinatisque caloris viribus copiæque in certam materiæ quantitatem dispositionemque, certas actiones et certæ materiæ quantitati certam determinatamque caloris copiam assignare liceat? Utinam id alii et perspicaciore prædíti ingenio et quibus in summâ tranquillitate rerum naturam perscrutari licuerit assequantur, ut homines non omnium modo scientes sed et potentes fiant." — *De Rer. Nat.* i. 17. Perhaps Bacon may quote from the edition published in 1565 [or from a copy corrected by conjecture; for there is evidently something wrong in the passage as it stands. — *J. S.*]

[2] Arist. Meteor. iii. 4.

tanquam oblitus. Secundum est, calorem actione sua propria perpetuo vertere ens in humidum, et quod calori siccitas nullo modo coëat, nec frigori humiditas.[1] Idem enim esse attenuare et humectare; atque quod maxime tenue, id etiam maxime humidum esse: cum per humidum intelligatur id quod facillime cedit, abit in partes, et rursus se restituit, atque ægre finitur aut consistit. Quæ omnia magis insunt flammæ, quam aëri; qui a Peripateticis constituitur maxime humidus. Itaque calorem, humidum perpetuo allicere, depascere, extendere, indere, generare; contra, frigus omnia agere in siccitatem, concretionem, duritiem; ubi vult Aristotelem et hebetem in observatione, et sibi discordem, et erga experientiam imperiosum et libidinosum videri, quod calorem cum siccitate copulet.[2] Nam quod aliquando entia desiccet calor, id per accidens fieri; nimirum in corpore dissimilari et ex partibus aliis magis crassis aliis magis tenuibus coagmentato, eliciendo et (per attenuationem) exitum dando parti tenuiori, dum pars crassior inde cogatur et magis se constringat: quæ tamen ipsa pars crassior, si advenerit calor ferocior, et ipsa fluit; ut in lateribus manifestum est. Primo enim calor non ita fervens,[3] lutum cogit in lateres, tenuiore parte evaporata; at fortior calor etiam illam substantiam lateritiam solvit in vitrum. Atque hæc duo dogmata veluti errorum redargutiones censeri possunt; tertium plane affirmat, neque id solum, sed et perspicue distinguit subactionis modum. Is duplex est, vel rejiciendo, vel vertendo; atque alteru-

1 "Propria igitur caloris, et caloris opus humiditas." — *De Rer. Nat.* iii. 14.

2 "Naturæ itidem sensuique et sibi etiam ipsi discors Aristoteles calori siccitatem et frigori humorem copulat." — *Ib.* l. c.

3 *servans* in the original. — *J. S.*

ter ex iis modis perducitur in actum, secundum vim caloris et dispositionem materiæ. Cujus rei tamen duo videntur tanquam canones. Unus, quod cum calidum et frigidum magna mole et tanquam justo exercitu concurrunt, sequitur ejectio. Nam entia, veluti acies, loco moventur et impelluntur. Ubi vero minore quantitate res geritur, tum sequitur versio;[1] nam interimuntur entia et naturam potius quam locum mutant. Hujus rei insigne et nobile exemplum esse in regionibus aëris superioribus, quæ licet ad calorem cœlestem magis appropinquent, tamen frigidiores inveniuntur quam confinia terræ. In illis enim locis, postquam propius ad sedem primi calidi ventum est, calor se colligens universam frigoris vim quæ adscenderat simul ejicit et detrudit, et aditu prohibet. Quinetiam similiter fieri posse, ut sint per profunda terræ calores vehementiores quam in superficie; postquam scilicet ad sedem primi frigidi appropinquatio facta est, quod se excitans, magno impetu calidum rejicit, et fugit,[2] et in se vertit. Alter canon est, quod in aperto sequitur ejectio; in clauso versio. Hoc autem insigniter conspici in vasibus occlusis, ubi emissio corporis attenuati (quod spiritum fere vocamus) prohibita et retrusa profundas et intrinsecas in corporibus alterationes et fermentationes generat. At hoc ipsum similiter fieri, cum corpus ob partium compactionem sibi ipsi instar vasis occlusi est. Atque hæc sunt quæ Telesio, et fortasse Parmenidi, circa rerum principia visa sunt, nisi quod Telesius hylen addidit de proprio; peripateticis scilicet notionibus depravatus.

[1] It does not appear that Telesius recognised the possibility of transforming heat into cold, or vice versa, which seems to be implied by the word versio.

[2] So in the original. — J. H.

Atque similia veri fuissent quæ a Telesio dicuntur, si homo tollatur e natura, et simul artes mechanicæ quæ materiam vexant, atque fabrica mundi simpliciter spectetur. Nam pastoralis quædam videtur ista philosophia, quæ mundum contemplatur placide, et tanquam per otium. Siquidem de systemate mundi disserit non male, de principiis imperitissime. Quin et in ipso quoque systemate ingens est lapsus, quod tale constituat systema quod videri possit æternum, nec supponat chaos et mutationes schematismi magni. Sive enim ea est Telesii philosophia, sive Peripateticorum, sive quæ alia, quæ in eum modum systema instruat, libret, muniat, ut non videatur fluxisse a chao; ea levior philosophia videtur, atque omnino ex angustiis pectoris humani. Nam omnino secundum sensum philosophanti materiæ æternitas asseritur; mundi (qualem eum intuemur) negatur; quod et priscæ sapientiæ, et ei qui ad ipsam proxime accedit, Democrito, visum est. Idem sacræ literæ testantur. Illud præcipue interest; quod illæ etiam materiam a Deo; hi ex sese statuunt. Tria enim videntur esse dogmata quæ scimus ex fide circa hanc rem. Primo, quod materia creata sit ex nihilo. Secundo, quod eductio systematis fuerit per verbum omnipotentiæ, neque quod materia se ipsa eduxerit e chao in schematismum illum. Tertio, quod schematismus ille (ante prævaricationem) fuerit optimus ex iis quæ materia (qualis creata erat) suscipere posset. At philosophiæ illæ ad nullum horum adscendere potuerunt. Nam et creationem ex nihilo exhorrent, et hunc schematismum post multas ambages et molimina materiæ eductum sentiunt; nec de optimitate laborant, cum schematismus asseratur occiduus et variabilis. In his itaque fidei

atque ejus firmamentis standum. Utrum vero materia illa creata, per longos seculorum circuitus, ex vi primo indita se in illum optimum schematismum colligere et vertere potuisset (quod missis ambagibus ex verbi imperio continuo fecit), non inquirendum fortasse est. Tam enim est miraculum, et ejusdem omnipotentiæ, repræsentatio temporis quam efformatio entis. Videtur autem natura divina utraque omnipotentiæ emanatione se insignire voluisse: primo, operando omnipotenter super ens et materiam, creando scilicet ens e nihilo; secundo, super motum et tempus, anticipando ordinem naturæ, et accelerando processum entis. Verum hæc ad parabolam de Cœlo pertinent, ubi quæ nunc breviter perstringimus fusius disseremus. Itaque ad principia Telesii pergendum. Atque utinam hoc saltem semel et inter omnes conveniret, ne aut ex non entibus entia, aut ex non principiis principia, constitui placeret, neque manifesta recipiatur contradictio. Principium autem abstractum non est ens; rursus ens mortale non est principium; ut necessitas plane invincibilis hominum cogitationes (si sibi constare velint) compellat ad atomum, quod est verum ens, materiatum, formatum, dimensum, locatum, habens antitypiam, appetitum, motum, emanationem. Idem per omnium corporum naturalium interitus manet inconcussum et æternum. Nam cum tot et tam variæ sint corporum majorum corruptiones, omnino necesse est ut quod tanquam centrum manet immutabile id aut potentiale quiddam sit, aut minimum. At potentiale non est; nam potentiale primum, reliquorum quæ sunt potentialia simile esse non potest, quæ aliud actu sunt, aliud potentia. Sed necesse est ut plane abstractum sit,

cum omnem actum abneget, et omnem potentiam contineat. Itaque relinquitur, ut illud immutabile sit minimum; nisi forte quis asserat omnino principia nulla existere, sed rem alteram alteri pro principiis esse, legem atque ordinem mutationis constantia esse et æterna, essentiam ipsam fluxam et mutabilem. Atque satius foret hujusmodi quiddam diserte affirmare, quam studio æternum aliquod principium statuendi, in durius incommodum incidere, ut idem principium ponatur phantasticum. Illa enim prior ratio aliquem exitum habere videtur, ut res mutentur in orbem; hæc prorsus nullum, quæ notionalia et mentis adminicula habet pro entibus. Et tamen quod hoc ipsum nullo modo fieri possit, postea docebimus. Telesio tamen *hyle* placuit, quam ex juniore ævo postnatam in Parmenidis philosophiam transtulit. At certamen instituit Telesius agentium suorum principiorum mirum et plane iniquum, et copiis et genere bellandi. Nam quod ad copias attinet, terra ei est unica, at cœli exercitus ingens; etiam terra puncti fere instar, cœli vero spatia et regiones immensæ. Neque huic incommodo illud subvenire queat, quod terra et connaturalia ejus ex materia maxime compacta asserantur, cœlum contra et ætherea ex materia maxime explicata. Licet enim plurimum certe intersit, tamen hæc res nullo modo copias vel longo intervallo æquabit. At robur dogmatis Telesii versatur in hoc vel præcipue, si tanquam æqualis portio hyles (secundum quantum, non secundum exporrectionem) utrique principio agenti assignetur, ut res durare possint, et systema constitui et stabiliri. Quicunque enim cum Telesio sentiet in cæteris, et exsuperantiam hyles, præsertim tam amplo excessu, in uno principio,

ad alterum recipiet, hærebit nec se omnino explicabit. Itaque in dialogo Plutarchi de facie in orbe lunæ, sana mente proponitur illa consideratio, non esse verisimile, in dispersione materiæ naturam quicquid compacti corporis erat in unicum terræ globum conclusisse, tot interim volventibus globis astrorum. Huic vero cogitationi tam immoderate indulsit Gilbertus, ut non solum terram et lunam, sed complures alios globos solidos et opacos per expansionem cœli inter globos lucentes sparsos assereret.[1] Quin et ipsi Peripatetici, postquam cœlestia suo statu, sublunaria autem per successionem et renovationem æterna posuissent, non confisi sunt se hoc dogma tueri posse, nisi elementis veluti æquas materiæ portiones assignassent. Hoc est enim illud, quod de decupla illa portione qua ambiens elementum interius elementum superet consomniant. Neque ista eo adducimus, quod nullum ex iis nobis placeat, sed ut ostendamus inopinabile quiddam esse, atque cogitationem prorsus male mensuratam, si quis terram contrarium agens cœlo principium statuat: quod Telesius fecit. Atque hoc ipsum durius multo invenitur, si quis præter quantum ipsum, disparem virtutem et actum cœli et terræ intueatur. Perdita enim omnino sit dimicationis conditio, si ex altera parte telorum hostilium ictus perferantur, ex altera non pertingant, sed citra cadant. At liquet plane solis vires in terram mitti; terræ autem vires usque ad solem pervenire nemo spondeat. Etenim inter omnes virtutes quas natura parit, illa lucis et umbræ longissime emittitur, et maximo spatio sive orbe circumfunditur. Umbra autem terræ citra solem terminatur, cum lux solis, si terra diaphana esset, globum terræ transverberare

[1] Gilbert, Nov. Phys. i. 10.

possit. Nominatum calidum, frigidum, (de quibus nunc est sermo) nunquam deprehenduntur tam magna spatia vincere in virtute sua perferenda, quam lux et umbra. Itaque si umbra terræ non pertingit ad solem, multo minus frigidum terræ eo adspirare posse consentaneum est. Id si ita sit, nempe ut sol et calidum in quædam corpora media agant, quo contrarii principii virtus non adscendat, nec ullo modo eorum actum impediat; necesse est ut illa (sol, inquam, et calidum) proxima quæque occupent, et dein remotiora quoque conjungant, ut tandem futura sit Heracliti conflagratio, solari et cœlesti natura gradatim versus terram et confinia ejus descendente et magis appropinquante. Neque illa admodum conveniunt, ut vis illa naturam suam imponendi et multiplicandi et alia in se vertendi, quam Telesius principiis attribuit, non operetur in similia æque aut magis quam in contraria; ut cœlum jam excandescere debuerit, et stellæ inter se committi. Verum ut propius accedamus, quatuor omnino demonstrationes proponendæ videntur, quæ Telesii philosophiam de principiis plane convellere et destruere possint, etiam singulæ, multo magis conjunctæ. Harum prima est, quod inveniantur in rebus nonnullæ actiones et effectus, etiam ex potentissimis et latissime diffusis, quæ ad calorem et frigus nullo modo referri possint. Proxima, quod inveniantur naturæ nonnullæ quarum calor et frigus sint effectus et consecutiones; neque id ipsum per excitationem caloris præinexistentis, aut admotionem caloris advenientis; sed prorsus per quæ calor et frigus in primo esse ipsorum indantur et generentur. Itaque principii ratio in iis ex utraque parte deficit, tum quia aliquid non ex ipsis, tum quia ipsa ex aliquo. Tertia, quod etiam ea quæ a calore et frigore

originem ducunt (quæ certe sunt quam plurima) tamen procedunt ab illis tanquam ab efficiente et organo, non tanquam a causa propria et intima. Postremo, quod conjugatio illa quatuor connaturalium omnino permiscetur et confunditur. Quare de his sigillatim dicemus. Atque alicui fortasse vix operæ pretium videri possit, nos in philosophia Telesii arguenda tam diligenter versari, philosophia scilicet non admodum celebri aut recepta. Verum nos hujusmodi fastidia nil moramur. De Telesio autem bene sentimus, atque eum ut amantem veritatis et scientiis utilem et nonnullorum placitorum emendatorem et novorum hominum primum agnoscimus. Neque tamen nobis cum eo res est tanquam Telesio, sed tanquam instauratore philosophiæ Parmenidis, cui multa debetur reverentia. Sed illud in primis in causa est quod hæc fusius agamus, quod in eo qui primus nobis occurrit complura disserimus, quæ ad sequentium sectarum (de quibus postmodum tractandum erit) redargutionem transferri possint, ne sæpius eadem dicere sit necesse. Sunt enim errorum (licet diversorum) fibræ miris modis inter se implicatæ et intextæ, quæ tamen sæpenumero una redargutione, tanquam falce, demeti et succidi possint. Verum, ut occœpimus dicere, videndum quales inveniantur in rebus virtutes et actiones, quæ ad calidum et frigidum nullo rerum consensu aut ingenii violentia trahi possint. Primo itaque sumendum quod a Telesio datur, materiæ summam æternum constare, nec augeri aut minui. Hanc ille dotem, qua materia se servat et sustinet, transmittit ut passivam, et tanquam ad rationem quanti potius quam ad formam et actionem pertinentem, ac si nihil opus esset eam calori et frigori deputare, quæ agentium tantum formarum et virtutum fontes ponun-

tur; materiam enim non simpliciter, sed omni agente virtute destitui et exui. Atque hæc asseruntur magno mentis errore, et prorsus mirabili, nisi quod consensus atque opinio pervulgata et inveterata miraculum tollit. Nil enim simile fere inter errores reperitur, quam ut quis virtutem istam materiæ inditam (per quam ipsa se ab interitu vindicat, adeo ut minima quæque materiæ portio nec universa mundi mole obrui nec omnium agentium vi et impetu destrui aut ullo modo annihilari et in ordinem redigi queat, quin et spatii nonnihil occupet, et renitentiam servet cum dimensione impenetrabili, et ipsa vicissim aliquid moliatur, nec se deserat) pro agente virtute non habeat; cum contra sit omnium virtutum longe potentissima, et plane insuperabilis, et veluti merum fatum et necessitas. Hanc autem virtutem nec conatur Telesius ad calidum et frigidum referre. Atque hoc recte; neque enim scilicet aut incendium aut torpor et congelatio huic rei aliquid addunt vel detrahunt, nec super eum aliquid possunt; cum ipsa interim et in sole, et ad centrum terræ, et ubique vigeat. Sed in eo lapsus videtur, quod molem materiæ certam et definitam agnoscit; ad virtutem qua se numeris suis tueatur cæcutit, eamque (profundissimis Peripateticorum tenebris immersus) accessorii loco ducit; cum sit maxime principalis, corpus suum[1] vibrans, aliud submovens, solida et adamantina in seipso, atque unde decreta et possibilis et impossibilis emanant authoritate inviolabili. Schola itidem vulgaris eam facili verborum complexu pueriliter prensat, satisfactum huic cogitationi putans, si duo corpora in eodem loco non posse esse pro canone ponat, virtutem autem istam atque ejus modum nunquam apertis oculis contempla-

[1] [So in the original.] The sense appears to require *unum*.

tur et ad vivum dissecat; parum scilicet gnara, quanta ex ea pendeant, et qualis lux inde scientiis exoriatur. Verum (quod nunc agitur) ista virtus quantacunque extra Telesii principia cadit. Transeundum jam ad virtutem illam quæ ad priorem hanc est tanquam antistropha, eam scilicet quæ nexum materiæ tuetur. Ut enim materia materia obrui non vult, ita nec materia a materia divelli. Atque nihilominus utrum hæc naturæ lex sit æque ac illa altera peremptoria, magnam habet dubitationem. Telesio enim, quemadmodum et Democrito vacuum coacervatum et sine meta dari placuit, ut entia singularia contiguum suum deponant, nonnunquam et deserant, ægre (ut aiunt) et illibenter, sed majore nempe aliqua violentia domita et coacta; idque ille nonnullis experimentis demonstrare contendit, ea potissimum adducens, quæ passim citantur ad abnegandum et refellendum vacuum, eaque tanquam extrahens et amplians eo modo, ut entia videri possint in levi aliqua necessitate posita contiguum illud tenere; sin majorem in modum torqueantur, vacuum admittere; sicuti in clepsydris aqueis, in quibus si foramen per quod aqua descendere possit minutius sit, spiraculo egebunt, ut aqua descendat; sin latius, etiam absque spiraculo, aqua in foramen majore mole incumbens, et vacuum supra nil morata, deorsum fertur. Similiter in follibus, in quibus si eos[1] comprimas et occludas ut nullus illabenti aëri aditus pateat ac postea eleves et expandas, si pellis gracilis sit et debilis, dirumpitur pellis; si crassa et frangi inepta, non item; et alia hujusmodi.[2] Verum experimenta ista nec exacte probata sunt, nec inquisitioni omnino satisfaciunt aut quæstio-

[1] *ea* in the original. — *J. S.*

[2] De Rer. Nat. i. 25.

nem terminant; atque licet per illa Telesius se addere rebus et inventis putet et quod ab aliis confusius observatum est subtilius distinguere nitatur, tamen nullo modo par rebus evadit nec exitum rei evolvit, sed in mediis prorsus deficit; quod ex more est et ipsi et Peripateticis, qui ad experimenta contuenda instar noctuarum sunt, neque id tam ob facultatis imbecillitatem, sed ob cataractas opinionum, et contemplationis plenæ et fixæ impatientiam. Quæstio vero ista (ex maxime arduis) quousque detur vacuum, et ad quæ spatia fieri possit seminum vel coitio vel distractio, et quid sit in hoc genere peremptorium et invariabile, ad locum ubi de vacuo tractandum erit rejicimus. Neque enim multum interest ad id quod nunc agitur, utrum natura vacuum penitus respuat, an entia (ut emendatius se loqui putat Telesius[1]) mutuo contactu gaudeant. Illud enim planum facimus, istam sive vacui fugam, sive contactus cupidinem, nullo modo a calido et frigido pendere, nec a Telesio ipsi[2] adscribi, nec ex rerum ulla evidentia illis adscribi posse; cum materia loco mota aliam prorsus materiam trahat, sive illa sit calida sive frigida, sive liquida sive sicca, sive dura sive mollis, sive amica sive inimica, adeo ut corpus calidum corpus gelidissimum citius attraxerit ut ei adsit, quam se ab omni corpore disjungi et deseri patiatur. Nam vinculum materiæ fortius est quam dissidium calidi et frigidi. Et sequacitas materiæ non curat diversitatem formarum specialium. Itaque nullo modo hæc virtus nexus ab illis principiis calidi et frigidi. Sequuntur virtutes duæ invicem oppositæ, quæ regnum hoc principiorum (ut

[1] "Entia prorsus omnia mutuum contactum sentire et summopere eo oblectari . . . apparent." — *De Rer. Nat.* i. 6.

[2] So in the original. I think it should be *ipso*. — *J. S.*

videri possit) ad calidum et frigidum detulerunt, sed jure male enucleato; eas dicimus, per quas entia se aperiunt et rarefaciunt, dilatant et expandunt, ita ut majus spatium occupent et se in majorem sphæram conjiciant; aut rursus se claudunt et condensant, coarctant et contrahunt, ita ut spatiis decedant et in minorem sphæram se recipiant. Ostendendum itaque est, quatenus ista virtus a calido et frigido ortum habeat, et quatenus seorsum moretur, nec cum illa rationes misceat. Atque verissimum est, quod affirmat Telesius, rarum et densum caloris et frigoris esse veluti opificia propria; longe enim maximæ sunt illorum partes ad hoc, ut corpora majus et minus spatium occupent; sed tamen confusius ista accipiuntur. Videntur enim corpora quandoque ab una spatiatione naturali in alteram migrare et se transferre, idque libenter et tanquam volentia, et formam mutantia; quandoque autem tantummodo a naturali spatiatione depulsa, et manente forma veteri in consuetam spatiationem reverti. Atque virtus illa progressiva in novum spatium a calido et frigido fere regitur. At virtus altera restitutiva non item, siquidem expandit se aqua in vaporem et aërem, oleum similiter et pinguia in halitum et flammam, ex vi caloris; nec (si perfecte transmigraverint) reverti satagunt; quin et aër ipse ex calore intumescit et extenditur. Quod si migratio fuerit semiplena, post caloris abscessum in se facile recidit; ut etiam in virtute restitutiva partes frigoris et caloris sint nonnullæ. At quæ non mediante calore sed violentia aliqua extensa sunt et distracta, etiam absque ulla frigoris accessione aut diminutione caloris in priora spatia (cessante violentia) cupidissime revertuntur; ut in exsuctione ovi vitrei, et follibus levatis.

Id vero in solidis et crassis longe evidentius est. Nam si distendatur pannus vel chorda, remota vi magna velocitate resiliunt; atque eadem est compressionis ratio. Nam aër violentia aliqua contrusus et incarceratus multo conatu erumpit; atque adeo omnis ille motus mechanicus quo durum a duro percutitur, qui vulgo motus violenti nomine appellatur, per quem res solidæ mittuntur et volant per aërem et aquam, nihil aliud est quam nixus partium corporis emissi ad se expediendum a compressione; et tamen nusquam hic apparent vestigia calidi et frigidi. Neque est quod quis argutetur ex doctrina Telesii hoc modo, ut dicat; Esse singulis spatiationibus naturalibus assignatam portionem quandam calidi et frigidi, ex certa quadam analogia: Itaque fieri posse ut tametsi nihil addatur caloris et frigoris, tamen si spatia materiati extendantur aut contrahantur, res eodem recidat,[1] quia plus et minus imponitur materiæ in spatio, quam pro ratione caloris et frigoris. Verum ista licet non absurda dictu, tamen sunt eorum qui semper aliquid comminisci solent ut quod semel visum est teneant, nec naturam et res persequuntur. Nam si addatur calor et frigus hujusmodi corporibus extensis aut compressis, idque majore mensura quam pro ratione et natura corporis ipsius, veluti si pannus ille tensus calefiat ad ignem, tamen nullo modo rem compensabit, nec impetum restitutionis exstinguet. Itaque planum jam fecimus, istam virtutem spatiationis ex calore et frigore in parte notabili non pendere, cum tamen sit ipsa illa virtus, quæ plurimum authoritatis his principiis tribuerit. Sequuntur duæ virtutes quæ omnibus in ore sunt, atque longe et late patent, per quas scilicet corpora massas sive congrega-

[1] *Recidit* in original. — *J. S.*

tiones majores rerum connaturalium petunt; in quarum observatione, ut in reliquis, aut nugantur homines aut plane aberrant. Schola enim communis satis habet, si motum naturalem a violento distinguat; et gravia deorsum, levia sursum ferri ex motu naturali pronuntiet. Verum parum proficiunt ad philosophiam hujusmodi speculationes. Ista enim natura, ars, violentia, compendia verborum sunt et nugæ. Debuerunt autem hunc motum non tantum ad naturam referre, sed etiam affectum et appetitum particularem et proprium corporis naturalis in hoc ipso motu quærere. Sunt enim et alii motus complures naturales ex passionibus rerum longe diversis. Itaque res secundum differentias proponenda est. Quin et ipsi illi motus quos violentos appellant magis secundum naturam appellari possint, quam iste quem vocant naturalem; si sit illud magis secundum naturam quod est fortius, aut etiam quod est magis ex ratione universi. Nam motus iste adscensus et descensus non admodum imperiosus est, nec etiam universalis, sed tanquam provincialis et secundum regiones; quin et aliis motibus obsequens et subjectus. Quod vero gravia deorsum ferri aiunt, levia sursum, idem est ac si dicerent, gravia esse gravia, levia levia. Quod enim prædicatur, id ex vi ipsa termini in subjecto assumitur. Si vero per grave densum, per leve rarum intelligunt, promovent nonnihil; ita tamen ut ad adjunctum et concomitans, potius quam ad causam, rem deducant. Qui vero gravium appetitum ita explicant, ut ad centrum terræ illa ferri contendant, levia ut[1] ad circumferentiam et ambitum cœli, tanquam ad loca propria; asserunt certe aliquid, atque etiam ad causam innuunt, sed omnino perperam. Loci

[1] So in the original; but the *ut* ought probably to be omitted. — *J. S.*

enim nullæ sunt vires, neque corpus nisi a corpore patitur, atque omnis incitatio corporis, quæ videtur esse ad se collocandum, appetit atque molitur configurationem versus aliud corpus, non collocationem aut situm simplicem.

NEW ATLANTIS.[1]

[1] The *Thema Cœli*, had it stood by itself, would have followed here; for it belongs properly to this class, and was written before the *New Atlantis*. But being so closely connected with the *Descriptio Globi Intellectualis*, which belongs to the next, it was thought better not to separate them. — *J. S.*

PREFACE.

THE *New Atlantis* seems to have been written in 1624, and, though not finished, to have been intended for publication as it stands. It was published accordingly by Dr. Rawley in 1627, at the end of the volume containing the *Sylva Sylvarum;* for which place Bacon had himself designed it, the subjects of the two being so near akin; the one representing his idea of what should be the end of the work which in the other he supposed himself to be beginning. For the story of Solomon's House is nothing more than a vision of the practical results which he anticipated from the study of natural history diligently and systematically carried on through successive generations.

In this part of it, the work may probably be considered as complete. Of the state of Solomon's House he has told us all that he was as yet qualified to tell. His own attempts to "interpret nature" suggested the apparatus which was necessary for success: he had but to furnish Solomon's House with the instruments and preparations which he had himself felt the want of. The difficulties which had baffled his single efforts to provide that apparatus for himself suggested the constitution and regulations of a society formed to overcome them: he had but to furnish Solomon's House

with the helps in head and hand which he had himself wished for. His own intellectual aspirations suggested the result: he had but to set down as known all that he himself most longed to know. But here he was obliged to stop. He could not describe the *process* of a perfect philosophical investigation; because it must of course have proceeded by the method of the *Novum Organum*, which was not yet expounded. Nor could he give a particular example of the result of such investigation, in the shape of a Form or an Axiom; for that presupposed the completion, not only of the *Novum Organum*, but (at least in some one subject) of the Natural History also; and no portion of the Natural History complete enough for the purpose was as yet producible. Here therefore he stopped; and it would almost seem that the nature of the difficulty which stood in his way had reminded him of the course he ought to take; for just at this point (as we learn from Dr. Rawley) he did in fact leave his fable and return to his work. He had begun it with the intention of exhibiting a model political constitution, as well as a model college of natural philosophy; but "his desire of collecting the natural history diverted him, which he preferred many degrees before it." And in this, according to his own view of the matter, he was no doubt right; for though there are few people now who would not gladly give all the *Sylva Sylvarum*, had there been ten times as much of it, in exchange for an account of the laws, institutions, and administrative arrangements of Bensalem, it was not so with Bacon; who being deeper read in the phenomena of the human heart than in those of the material world, probably thought the perfect knowledge of na-

ture an easier thing than the perfect government of men, — easier and not so far off; and therefore preferred to work where there was fairest hope of fruit.

To us, who can no longer hope for the fruits which Bacon expected, the *New Atlantis* is chiefly interesting as a record of his own feelings. Perhaps there is no single work of his which has so much of himself in it. The description of Solomon's House is the description of the vision in which he lived, — the vision not of an ideal world released from the natural conditions to which ours is subject, but of our own world as it might be made if we did our duty by it; of a state of things which he believed would one day be actually seen upon this earth such as it is by men such as we are; and the coming of which he believed that his own labours were sensibly hastening. The account of the manners and customs of the people of Bensalem is an account of his own taste in humanity; for a man's ideal, though not necessarily a description of what he is, is almost always an indication of what he would be; and in the sober piety, the serious cheerfulness, the tender and gracious courtesy, the open-handed hospitality, the fidelity in public and chastity in private life, the grave and graceful manners, the order, decency, and earnest industry, which prevail among these people, we recognise an image of himself made perfect, — of that condition of the human soul which he loved in others, and aspired towards in himself. Even the dresses, the household arrangements, the order of their feasts and solemnities, their very gestures of welcome and salutation, have an interest and significance independent of the fiction, as so many records of Bacon's personal taste in such matters. Nor

ought the stories which the Governor of the House of Strangers tells about the state of navigation and population in the early post-diluvian ages, to be regarded merely as romances invented to vary and enrich the narrative, but rather as belonging to a class of serious speculations to which Bacon's mind was prone. As in his visions of the future, embodied in the achievements of Solomon's House, there is nothing which he did not conceive to be really practicable by the means which he supposes to be used; so in his speculations concerning the past, embodied in the traditions of Bensalem, I doubt whether there be any (setting aside, of course, the particular history of the fabulous island) which he did not believe to be historically probable. Whether it were that the progress of the human race in knowledge and art seemed to him too small to be accounted for otherwise than by supposing occasional tempests of destruction, in which all that had been gathered was swept away, — or that the vicissitudes which had actually taken place during the short periods of which we know something had suggested to him the probability of similar accidents during those long tracts of time of which we know nothing, — or merely that the imagination is prone by nature to people darkness with shadows, — certain it is that the tendency was strong in Bacon to credit the past with wonders; to suppose that the world had brought forth greater things than it remembered, had seen periods of high civilisation buried in oblivion, great powers and peoples swept away and extinguished. In the year 1607, he avowed before the House of Commons a belief that in some forgotten period of her history (possibly during the Heptarchy) England had been far better peopled than she

was then. In 1609, when he published the *De Sapientiâ Veterum*, he inclined to believe that an age of higher intellectual development than any the world then knew of had flourished and passed out of memory long before Homer and Hesiod wrote; and this upon the clearest and most deliberate review of all the obvious objections; and more decidedly than he had done four years before when he published the *Advancement of Learning*. And I have little doubt that when he wrote the *New Atlantis* he thought it not improbable that the state of navigation in the world 3000 years before was really such as the Governor of the House of Strangers describes; that some such naval expeditions as those of Coya and Tyrambel may really have taken place; and that the early civilisation of the Great Atlantis may really have been drowned by a deluge and left to begin its career again from a state of mere barbarism.

Among the few works of fiction which Bacon attempted, the *New Atlantis* is much the most considerable; which gives an additional interest to it, and makes one the more regret that it was not finished according to the original design. Had it proceeded to the end in a manner worthy of the beginning, it would have stood, as a work of art, among the most perfect compositions of its kind.

The notes to this piece, which are not marked with Mr. Ellis's initials, are mine.

J. S.

NEW ATLANTIS:

A WORK UNFINISHED.

WRITTEN BY

THE RIGHT HONOURABLE

FRANCIS LORD VERULAM, VISCOUNT ST. ALBAN.

TO THE READER.

THIS fable my Lord devised, to the end that he might exhibit therein a model or description of a college instituted for the interpreting of nature and the producing of great and marvellous works for the benefit of men, under the name of Salomon's House, or the College of the Six Days' Works. And even so far his Lordship hath proceeded, as to finish that part. Certainly the model is more vast and high than can possibly be imitated in all things; notwithstanding most things therein are within men's power to effect. His Lordship thought also in this present fable to have composed a frame of Laws, or of the best state or mould of a commonwealth; but foreseeing it would be a long work, his desire of collecting the Natural History[1] diverted him, which he preferred many degrees before it.

This work of the *New Atlantis* (as much as concerneth the English edition) his Lordship designed for this place;[2] in regard it hath so near affinity (in one part of it) with the preceding Natural History.

W. RAWLEY.

[1] In the Latin translation Rawley adds, *aliarumque Instaurationis partium contexendarum;* alluding probably to the *De Augmentis*, the only portion of the Instauration, not belonging to the Natural History, which he seems to have been employed upon afterwards.

[2] It was published at the end of the volume containing the *Sylva Sylvarum*. The titlepage bears no date.

NEW ATLANTIS.

WE sailed from Peru, (where we had continued by the space of one whole year,) for China and Japan, by the South Sea;[1] taking with us victuals for twelve months; and had good winds from the east, though soft and weak, for five months' space and more. But then the wind came about, and settled in the west for many days, so as we could make little or no way, and were sometimes in purpose to turn back. But then again there arose strong and great winds from the south, with a point east; which carried us up (for all that we could do) towards the north: by which time our victuals failed us, though we had made good spare of them. So that finding ourselves in the midst of the greatest wilderness of waters in the world, without victual, we gave ourselves for lost men, and prepared for death. Yet we did lift up our hearts and voices to God above, who *showeth his wonders in the deep;* beseeching him of his mercy, that as in the beginning he discovered[2] the face of the deep, and

[1] The words "by the South Sea" are omitted in the translation.

[2] So in the original. If *discovered* be the right word, it must mean *removed the covering of* the face of the deep. But I think there must be some mistake. The Latin version has *quemadmodum in principio congregationes aquarum mandavit et Aridam apparere fecit.* The allusion is, no doubt, to Genes. i. 9.: "Let the waters under the heaven be gathered together unto one place, and let the dry land appear."

brought forth dry land, so he would now discover land to us, that we might[1] not perish. And it came to pass that the next day about evening, we saw within a kenning before us, towards the north, as it were thick clouds, which did put us in some hope of land; knowing how that part of the South Sea was utterly unknown; and might have islands or continents, that hitherto were not come to light. Wherefore we bent our course thither, where we saw the appearance of land, all that night; and in the dawning of the next day, we might plainly discern that it was a land; flat to our sight, and full of boscage; which made it shew the more dark. And after an hour and a half's sailing, we entered into a good haven, being the port of a fair city; not great indeed, but well built, and that gave a pleasant view from the sea:[2] and we thinking every minute long till we were on land, came close to the shore, and offered to land. But straightways we saw divers of the people, with bastons in their hands, as it were forbidding us to land; yet without any cries or fierceness, but only as warning us off by signs that they made. Whereupon being not a little discomforted, we were advising with ourselves what we should do. During which time there made forth to us a small boat, with about eight persons in it; whereof one of them had in his hand a tipstaff of a yellow cane, tipped at both ends with blue, who came aboard our ship, without any show of distrust at all. And when he saw one of our number present himself somewhat afore the rest, he drew forth a little scroll of parchment,

[1] *mought* in the original; a form of the word frequently, though not uniformly, adopted by Bacon. I have always substituted *might*.

[2] *ex qua parte Mare spectabat, elegantiam magnam præ se tulit.* — Lat. vers.

(somewhat yellower than our parchment, and shining like the leaves of writing tables, but otherwise soft and flexible,) and delivered it to our foremost man. In which scroll were written in ancient Hebrew, and in ancient Greek, and in good Latin of the School, and in Spanish, these words; "Land ye not, none of you; and provide to be gone from this coast within sixteen days, except you have further time given you. Meanwhile, if you want fresh water, or victual, or help for your sick, or that your ship needeth repair, write down your wants, and you shall have that which belongeth to mercy." This scroll was signed with a stamp of cherubins' wings, not spread but hanging downwards, and by them a cross. This being delivered, the officer returned, and left only a servant with us to receive our answer. Consulting hereupon amongst ourselves, we were much perplexed. The denial of landing and hasty warning us away troubled us much; on the other side, to find that the people had languages and were so full of humanity, did comfort us not a little. And above all, the sign of the cross to that instrument was to us a great rejoicing, and as it were a certain presage of good. Our answer was in the Spanish tongue; "That for our ship, it was well; for we had rather met with calms and contrary winds than any tempests. For our sick, they were many, and in very ill case; so that if they were not permitted to land, they ran danger of their lives." Our other wants we set down in particular; adding, "that we had some little store of merchandise, which if it pleased them to deal for, it might supply our wants without being chargeable unto them." We offered some reward in pistolets unto the servant, and a piece of crimson velvet to

be presented to the officer; but the servant took them not, nor would scarce look upon them; and so left us, and went back in another little boat which was sent for him.

About three hours after we had dispatched our answer, there came towards us a person (as it seemed) of place. He had on him a gown with wide sleeves, of a kind of water chamolet, of an excellent azure colour, far more glossy than ours; his under apparel was green; and so was his hat, being in the form of a turban, daintily made, and not so huge as the Turkish turbans; and the locks of his hair came down below the brims of it. A reverend man was he to behold. He came in a boat, gilt in some part of it, with four persons more only in that boat; and was followed by another boat, wherein were some twenty. When he was come within a flight-shot[1] of our ship, signs were made to us that we should send forth some to meet him upon the water; which we presently did in our ship-boat, sending the principal man amongst us save one, and four of our number with him. When we were come within six yards of their boat, they called to us to stay, and not to approach farther; which we did. And thereupon the man whom I before described stood up, and with a loud voice in Spanish, asked, "Are ye Christians?" We answered, "We were;" fearing the less, because of the cross we had seen in the subscription. At which answer the said person lifted up his right hand towards heaven, and drew it softly to his mouth, (which is the gesture

[1] *spiculi jactum.* When archers try which can shoot furthest, they call it flight-shooting. The distance would be between 200 and 300 yards. Old Double, according to Justice Shallow, would have "carried you a forehand shaft a fourteen and fourteen and half;" that is, 284 or 294 yards. See Hen. IV. Part II. act 3. sc. 2.

they use when they thank God,) and then said: "If ye will swear (all of you) by the merits of the Saviour that ye are no pirates, nor have shed blood lawfully nor unlawfully within forty days past, you may have licence to come on land." We said, "We were all ready to take that oath." Whereupon one of those that were with him, being (as it seemed) a notary, made an entry of this act. Which done, another of the attendants of the great person, which was with him in the same boat, after his lord had spoken a little to him, said aloud; "My lord would have you know, that it is not of pride or greatness that he cometh not aboard your ship; but for that in your answer you declare that you have many sick amongst you, he was warned by the Conservator of Health of the city that he should keep a distance." We bowed ourselves towards him, and answered, "We were his humble servants; and accounted for great honour and singular humanity towards us that which was already done; but hoped well that the nature of the sickness of our men was not infectious." So he returned; and a while after came the notary to us aboard our ship; holding in his hand a fruit of that country, like an orange, but of colour between orange-tawney and scarlet, which cast a most excellent odour. He used it (as it seemeth) for a preservative against infection. He gave us our oath; "By the name of Jesus and his merits:" and after told us that the next day by six of the clock in the morning we should be sent to, and brought to the Strangers' House, (so he called it,) where we should be accommodated of things both for our whole and for our sick. So he left us; and when we[1] offered him

[1] So ed. 1635. Ed. 1629 has *he*.

some pistolets, he smiling said, "He must not be twice paid for one labour:" meaning (as I take it) that he had salary sufficient of the state for his service. For (as I after learned) they call an officer that taketh rewards, *twice paid.*

The next morning early, there came to us the same officer that came to us at first with his cane, and told us, "He came to conduct us to the Strangers' House; and that he had prevented the hour, because we might have the whole day before us for our business. For," said he, "if you will follow my advice, there shall first go with me some few of you, and see the place, and how it may be made convenient for you; and then you may send for your sick, and the rest of your number which ye will bring on land." We thanked him, and said, "That this care which he took of desolate strangers God would reward." And so six of us went on land with him: and when we were on land, he went before us and turned to us, and said,[1] "He was but our servant and our guide." He led us through three fair streets; and all the way we went there were gathered some people on both sides standing in a row; but in so civil a fashion, as if it had been not to wonder at us[2] but to welcome us; and divers of them, as we passed by them, put their arms a little abroad; which is their gesture when they bid any welcome. The Strangers' House is a fair and spacious house, built of brick, of somewhat a bluer colour than our brick; and with handsome windows, some of glass, some of a kind of cambric oiled. He brought us first into a fair parlour above stairs, and

[1] *et dixit, per humanè certè, &c.*

[2] *ut viderentur non tam ad otiosum spectaculum convenisse quam &c.*

then asked us, "What number of persons we were? And how many sick?" We answered, "We were in all (sick and whole) one and fifty persons, whereof our sick were seventeen." He desired us to have patience a little, and to stay till he came back to us; which was about an hour after; and then he led us to see the chambers which were provided for us, being in number nineteen: they having cast it (as it seemeth) that four of those chambers, which were better than the rest, might receive four of the principal men of our company, and lodge them alone by themselves; and the other fifteen chambers were to lodge us two and two together. The chambers were handsome and cheerful chambers, and furnished civilly. Then he led us to a long gallery, like a dorture,[1] where he showed us all along the one side (for the other side was but wall and window) seventeen cells, very neat ones, having partitions of cedar wood. Which gallery and cells, being in all forty, (many more than we needed,) were instituted as an infirmary for sick persons. And he told us withal, that as any of our sick waxed well, he might be removed from his cell to a chamber; for which purpose there were set forth ten spare chambers, besides the number we spake of before. This done, he brought us back to the parlour, and lifting up his cane a little, (as they do when they give any charge or command,[2]) said to us, "Ye are to know that the custom of the land requireth, that after this day and to-morrow, (which we give you for removing of your people from your ship,) you are to keep within doors

[1] Dormitory. The Latin translation has, *qualia solent esse dormitoria monachorum.*

[2] *i. e.*, any charge which they have received from superior authority — (*quod in more illis erat quoties ministri mandata superiorum referunt*).

for three days. But let it not trouble you, nor do not think yourselves restrained, but rather left to your rest and ease. You shall want nothing, and there are six of our people appointed to attend you, for any business you may have abroad." We gave him thanks with all affection and respect, and said, "God surely is manifested in this land." We offered him also twenty pistolets; but he smiled, and only said; "What? twice paid!" And so he left us. Soon after our dinner was served in; which was right good viands, both for bread and meat:[1] better than any collegiate diet that I have known in Europe. We had also drink of three sorts, all wholesome and good; wine of the grape; a drink of grain, such as is with us our ale, but more clear; and a kind of cider made of a fruit of that country; a wonderful pleasing and refreshing drink. Besides, there were brought in to us great store of those scarlet oranges for our sick; which (they said) were an assured remedy for sickness taken at sea. There was given us also a box of small grey or whitish pills, which they wished our sick should take, one of the pills every night before sleep; which (they said) would hasten their recovery. The next day, after that our trouble of carriage and removing of our men and goods out of our ship was somewhat settled and quiet, I thought good to call our company together; and when they were assembled said unto them; "My dear friends, let us know ourselves, and how it standeth with us. We are men cast on land, as Jonas was out of the whale's belly, when we were as buried in the deep: and now we are on land, we are but between

[1] The translation has both for meat and *drink; tam respectu ciborum quam potûs:* and in the next line but one, *Potus erat trium generum, &c.*

death and life; for we are beyond both the old world and the new; and whether ever we shall see Europe, God only knoweth. It is a kind of miracle hath brought us hither: and it must be little less that shall bring us hence. Therefore in regard of our deliverance past, and our danger present and to come, let us look up to God, and every man reform his own ways. Besides we are come here amongst a Christian people, full of piety and humanity: let us not bring that confusion of face upon ourselves, as to show our vices or unworthiness before them. Yet there is more. For they have by commandment (though in form of courtesy) cloistered us within these walls for three days: who knoweth whether it be not to take some taste of our manners and conditions? and if they find them bad, to banish us straightways; if good, to give us further time. For these men that they have given us for attendance may withal have an eye upon us. Therefore for God's love, and as we love the weal of our souls and bodies, let us so behave ourselves as we may be at peace with God, and may find grace in the eyes of this people." Our company with one voice thanked me for my good admonition, and promised me to live soberly and civilly, and without giving any the least occasion of offence. So we spent our three days joyfully and without care, in expectation what would be done with us when they were expired. During which time, we had every hour joy of the amendment of our sick; who thought themselves cast into some divine pool of healing, they mended so kindly and so fast.

The morrow after our three days were past, there came to us a new man that we had not seen before,

clothed in blue as the former was, save that his turban was white, with a small red cross on the top. He had also a tippet of fine linen. At his coming in, he did bend to us a little, and put his arms abroad. We of our parts saluted him in a very lowly and submissive manner; as looking that from him we should receive sentence of life or death. He desired to speak with some few of us: whereupon six of us only stayed, and the rest avoided the room. He said, "I am by office governor of this House of Strangers, and by vocation I am a Christian priest; and therefore am come to you to offer you my service, both as strangers and chiefly as Christians. Some things I may tell you, which I think you will not be unwilling to hear. The state hath given you licence to stay on land for the space of six weeks; and let it not trouble you if your occasions ask further time, for the law in this point is not precise; and I do not doubt but myself shall be able to obtain for you such further time as may be convenient. Ye shall also understand, that the Strangers' House is at this time rich, and much aforehand; for it hath laid up revenue these thirty-seven years; for so long it is since any stranger arrived in this part: and therefore take ye no care; the state will defray you all the time you stay; neither shall you stay one day the less for that. As for any merchandise ye have brought, ye shall be well used, and have your return either in merchandise or in gold and silver: for to us it is all one. And if you have any other request to make, hide it not. For ye shall find we will not make your countenance to fall by the answer ye shall receive. Only this I must tell you, that none of you must go above a *karan*" (that is with them a mile and

an half) "from the walls of the city, without especial leave." We answered, after we had looked awhile one upon another admiring this gracious and parent-like usage; "That we could not tell what to say: for we wanted words to express our thanks; and his noble free offers left us nothing to ask. It seemed to us that we had before us a picture of our salvation in heaven; for we that were awhile since in the jaws of death, were now brought into a place where we found nothing but consolations. For the commandment laid upon us, we would not fail to obey it, though it was impossible but our hearts should be inflamed to tread further upon this happy and holy ground." We added; "That our tongues should first cleave to the roofs of our mouths, ere we should forget either his reverend person or this whole nation in our prayers." We also most humbly besought him to accept of us as his true servants, by as just a right as ever men on earth were bounden; laying and presenting both our persons and all we had at his feet. He said; "He was a priest, and looked for a priest's reward: which was our brotherly love and the good of our souls and bodies." So he went from us, not without tears of tenderness in his eyes; and left us also confused with joy and kindness, saying amongst ourselves, "That we were come into a land of angels, which did appear to us daily and prevent us with comforts, which we thought not of, much less expected."

The next day, about ten of the clock, the governor came to us again, and after salutations said familiarly, "That he was come to visit us:" and called for a chair, and sat him down: and we, being some ten of us, (the rest were of the meaner sort, or else gone

abroad,) sat down with him. And when we were set, he began thus: "We of this island of Bensalem," (for so they call it in their language,) "have this; that by means of our solitary situation, and of the laws of secrecy which we have for our travellers, and our rare admission of strangers, we know well most part of the habitable world, and are ourselves unknown. Therefore because he that knoweth least is fittest to ask questions, it is more reason, for the entertainment of the time, that ye ask me questions, than that I ask you." We answered; "That we humbly thanked him that he would give us leave so to do: and that we conceived by the taste we had already, that there was no worldly thing on earth more worthy to be known than the state of that happy land. But above all," (we said,) "since that we were met from the several ends of the world, and hoped assuredly that we should meet one day in the kingdom of heaven, (for that we were both parts Christians,) we desired to know (in respect that land was so remote, and so divided by vast and unknown seas, from the land where our Saviour walked on earth,) who was the apostle of that nation, and how it was converted to the faith?" It appeared in his face that he took great contentment in this our question: he said, "Ye knit my heart to you, by asking this question in the first place; for it sheweth that you *first seek the kingdom of heaven;* and I shall gladly and briefly satisfy your demand.

"About twenty years after the ascension of our Saviour, it came to pass that there was seen by the people of Renfusa, (a city upon the eastern coast of our island,) within night, (the night was cloudy and

calm,) as it might be some mile into the sea, a great pillar of light; not sharp, but in form of a column or cylinder, rising from the sea a great way up towards heaven: and on the top of it was seen a large cross of light, more bright and resplendent than the body of the pillar. Upon which so strange a spectacle, the people of the city gathered apace together upon the sands, to wonder; and so after put themselves into a number of small boats, to go nearer to this marvellous sight. But when the boats were come within about sixty yards of the pillar, they found themselves all bound, and could go no further; yet so as they might move to go about, but might not approach nearer: so as the boats stood all as in a theatre, beholding this light as an heavenly sign.[1] It so fell out, that there was in one of the boats one of the wise men of the society of Salomon's House; which house or college (my good brethren) is the very eye of this kingdom; who having awhile attentively and devoutly viewed and contemplated this pillar and cross, fell down upon his face; and then raised himself upon his knees, and lifting up his hands to heaven, made his prayers in this manner:

"'Lord God of heaven and earth, thou hast vouchsafed of thy grace to those of our order, to know thy works of creation, and the secrets of them; and to discern (as far as appertaineth to the generations of men) between divine miracles, works of nature, works of art, and impostures and illusions of all sorts.[2] I do here acknowledge and testify before this people, that the thing which we now see before our eyes is thy

[1] *tanquam* scenam *cœlestem*, in the translation.
[2] *illusiones dæmonum, cum imposturis omnimodis.*

Finger and a true Miracle; and forasmuch as we learn in our books that thou never workest miracles but to a divine and excellent end, (for the laws of nature are thine own laws, and thou exceedest them not but upon great cause,) we most humbly beseech thee to prosper this great sign, and to give us the interpretation and use of it in mercy; which thou dost in some part secretly promise by sending it unto us.'

"When he had made his prayer, he presently found the boat he was in moveable and unbound; whereas all the rest remained still fast; and taking that for an assurance of leave to approach, he caused the boat to be softly and with silence rowed towards the pillar. But ere he came near it, the pillar and cross of light brake up, and cast itself abroad, as it were, into a firmament of many stars; which also vanished soon after, and there was nothing left to be seen but a small ark or chest of cedar, dry, and not wet at all with water, though it swam. And in the fore-end of it, which was towards him, grew a small green branch of palm; and when the wise man had taken it with all reverence into his boat, it opened of itself, and there were found in it a Book and a Letter; both written in fine parchment, and wrapped in sindons of linen. The Book contained all the canonical books of the Old and New Testament, according as you have them, (for we know well what the Churches with you receive); and the Apocalypse itself,[1] and some other books of the New Testament which were not at that time written, were nevertheless in the Book. And for the Letter, it was in these words:

[1] The original has a semicolon after "itself," which would seem to connect this clause with the last. But the translation (*Apocalypsis ipsa*) shows that it was meant to be the beginning of a new sentence.

"'I Bartholomew, a servant of the Highest, and Apostle of Jesus Christ, was warned by an angel that appeared to me in a vision of glory, that I should commit this ark to the floods of the sea. Therefore I do testify and declare unto that people where God shall ordain this ark to come to land, that in the same day is come unto them salvation and peace and good-will, from the Father, and from the Lord Jesus.'

"There was also in both these writings, as well the Book as the Letter, wrought a great miracle, conform to that of the Apostles in the original Gift of Tongues. For there being at that time in this land Hebrews, Persians, and Indians, besides the natives, every one read upon the Book and Letter, as if they had been written in his own language. And thus was this land saved from infidelity (as the remain of the old world was from water) by an ark, through the apostolical and miraculous evangelism of St. Bartholomew." And here he paused, and a messenger came, and called him from us. So this was all that passed in that conference.

The next day, the same governor came again to us immediately after dinner, and excused himself, saying, "That the day before he was called from us somewhat abruptly, but now he would make us amends, and spend time with us, if we held his company and conference agreeable." We answered, "That we held it so agreeable and pleasing to us, as we forgot both dangers past and fears to come, for the time we heard him speak; and that we thought an hour spent with him, was worth years of our former life." He bowed himself a little to us, and after we were set again, he said; "Well, the questions are on your part." One

of our number said, after a little pause; "That there was a matter we were no less desirous to know, than fearful to ask, lest we might presume too far. But encouraged by his rare humanity towards us, (that could scarce think ourselves strangers, being his vowed and professed servants,) we would take the hardiness to propound it: humbly beseeching him, if he thought it not fit to be answered, that he would pardon it, though he rejected it." We said; "We well observed those his words, which he formerly spake, that this happy island where we now stood was known to few, and yet knew most of the nations of the world; which we found to be true, considering they had the languages of Europe, and knew much of our state and business; and yet we in Europe (notwithstanding all the remote discoveries and navigations of this last age,) never heard any of the least inkling or glimpse of this island. This we found wonderful strange; for that all nations have inter-knowledge[1] one of another either by voyage into foreign parts, or by strangers that come to them: and though the traveller into a foreign country doth commonly know more by the eye, than he that stayeth at home can by relation of the traveller; yet both ways suffice to make a mutual knowledge, in some degree, on both parts. But for this island, we never heard tell of any ship of theirs that had been seen to arrive upon any shore of Europe; no, nor of either the East or West Indies; nor yet of any ship of any other part of the world that had made return from them. And yet the marvel rested not in this. For the situation of it (as his lordship said) in the secret conclave of such a vast sea might cause it. But

[1] *enterknowledge* in the original.

then that they should have knowledge of the languages, books, affairs, of those that lie such a distance from them, it was a thing we could not tell what to make of; for that it seemed to us a condition and propriety of divine powers and beings, to be hidden and unseen to others, and yet to have others open and as in a light to them." At this speech the governor gave a gracious smile, and said; "That we did well to ask pardon for this question we now asked; for that it imported as if we thought this land a land of magicians, that sent forth spirits of the air into all parts, to bring them news and intelligence of other countries." It was answered by us all, in all possible humbleness, but yet with a countenance taking knowledge that we knew that he spake it but merrily, "That we were apt enough to think there was somewhat supernatural in this island; but yet rather as angelical than magical. But to let his lordship know truly what it was that made us tender and doubtful to ask this question, it was not any such conceit, but because we remembered he had given a touch in his former speech, that this land had laws of secrecy touching strangers." To this he said; "You remember it aright; and therefore in that I shall say to you I must reserve some particulars, which it is not lawful for me to reveal; but there will be enough left to give you satisfaction.

"You shall understand (that which perhaps you will scarce think credible) that about three thousand years ago, or somewhat more, the navigation of the world, (specially for remote voyages,) was greater than at this day. Do not think with yourselves that I know not how much it is increased with you within these six-score years: I know it well: and yet I say greater

then than now; whether it was, that the example of the ark, that saved the remnant of men from the universal deluge, gave men confidence to adventure upon the waters; or what it was; but such is the truth. The Phœnicians, and especially the Tyrians, had great fleets. So had the Carthaginians, their colony, which is yet further west. Toward the east, the shipping of Egypt and of Palestina was likewise great. China also, and the great Atlantis (that you call America), which have now but junks and canoes,[1] abounded then in tall ships. This island (as appeareth by faithful registers of those times) had then fifteen hundred strong ships, of great content. Of all this there is with you sparing memory, or none; but we have large knowledge thereof.

"At that time, this land was known and frequented by the ships and vessels of all the nations before named. And (as it cometh to pass) they had many times men of other countries, that were no sailors, that came with them; as Persians, Chaldeans, Arabians; so as almost all nations of might and fame resorted hither; of whom we have some stirps and little tribes with us at this day. And for our own ships, they went sundry voyages, as well to your Straits, which you call the Pillars of Hercules,[2] as to other parts in the Atlantic and Mediterrane Seas; as to Paguin[3]

[1] *Canoa's* in the original.

[2] Hercules is called by Edrisi Dhoulcarnain. He says he lived in the time of Abraham, and has been confounded with Iscander Dhoulcarnain, or Alexander the two-horned. That the limits beyond which it is impossible to pass were set up by Dhoulcarnain gives the obvious explanation of the passage in Chaucer's *Troilus and Cressida*: —

"I am tyl God me bettre mynde sende,
At Dulcarnon, right at my wytte's end."

"qui interpretes mire torsit." — *R. L. E.*

[3] Peking. It seems as if Bacon supposed that Peking was a sea-port. — *R. L. E.* [The translation adds *civitatem in Chinâ antiquissimam.*]

(which is the same with Cambaline[1]) and Quinzy,[2] upon the Oriental Seas, as far as to the borders of the East Tartary.

"At the same time, and an age after, or more, the inhabitants of the great Atlantis did flourish.[3] For though the narration and description which is made by a great man with you, that the descendants of Neptune planted there; and of the magnificent temple, palace, city, and hill; and the manifold streams of goodly navigable rivers, (which, as so many chains, environed the same site and temple); and the several degrees of ascent whereby men did climb up to the same, as if it had been a *scala cœli;* be all poetical and fabulous: yet so much is true, that the said country of Atlantis, as well that of Peru, then called Coya, as that of Mexico, then named Tyrambel, were mighty and proud kingdoms in arms, shipping, and riches: so mighty, as at one time (or at least within the space of ten years) they both made two great expeditions; they of Tyrambel through the Atlantic to the Mediterrane Sea; and they of Coya through the South Sea upon this our island. And for the former of these, which was into Europe, the same author amongst you (as it seemeth) had some relation from the Egyptian priest whom he

[1] Cambalu is the reading of the common text of Marco Polo. The word is properly Khambalik. It is the Tartar name for Peking. — *R. L. E.* [It is *Cambalu* in the translation; and in the English Bacon probably wrote *Cambalue.* — *J. S.*]

[2] The Quinsai of Marco Polo, now Hangchowfoo. — *R. L. E.*

[3] See Plato, Critias, p. 113., and Timæus, p. 25. Everything relating to the story of Atlantis has been collected by Humboldt, *Examen critique de l'Histoire de la Géographie*, &c., i. p. 167. Compare Martin, *Etudes sur le Timée;* and see Gesenius, *Monumenta Phœnicia*, for an account of a spurious Phœnician inscription, purporting to give the history of the destruction of Atlantis. It may be a question whether there be not some affinity between Atlantis and Homer's Phæacia. — *R. L. E.*

citeth. For assuredly such a thing there was. But whether it were the ancient Athenians that had the glory of the repulse and resistance of those forces, I can say nothing: but certain it is, there never came back either ship or man from that voyage. Neither had the other voyage of those of Coya upon us had better fortune, if they had not met with enemies of greater clemency. For the king of this island (by name Altabin) a wise man and a great warrior, knowing well both his own strength and that of his enemies, handled the matter so, as he cut off their land-forces from their ships; and entoiled both their navy and their camp with a greater power than theirs, both by sea and land; and compelled them to render themselves without striking stroke: and after they were at his mercy, contenting himself only with their oath that they should no more bear arms against him, dismissed them all in safety. But the Divine Revenge overtook not long after those proud enterprises. For within less than the space of one hundred years, the great Atlantis was utterly lost and destroyed: not by a great earthquake, as your man saith, (for that whole tract is little subject to earthquakes,) but by a particular deluge or inundation; those countries having, at this day, far greater rivers and far higher mountains to pour down waters, than any part of the old world. But it is true that the same inundation was not deep; not past forty foot, in most places, from the ground: so that although it destroyed man and beast generally, yet some few wild inhabitants of the wood[1] escaped. Birds also were saved by flying to the high trees and

[1] The translation says, of the *mountains: silvestres habitatores quidam montium.*

woods. For as for men, although they had buildings in many places higher than the depth of the water, yet that inundation, though it were shallow, had a long continuance; whereby they of the vale that were not drowned, perished for want of food and other things necessary. So as marvel you not at the thin population of America, nor at the rudeness and ignorance of the people; for you must account your inhabitants of America as a young people; younger a thousand years, at the least, than the rest of the world; for that there was so much time between the universal flood and their particular inundation. For the poor remnant of human seed which remained in their mountains peopled the country again slowly, by little and little; and being simple and savage people, (not like Noah and his sons, which was the chief family of the earth,) they were not able to leave letters, arts, and civility to their posterity; and having likewise in their mountainous habitations been used (in respect of the extreme cold of those regions) to clothe themselves with the skins of tigers, bears, and great hairy goats, that they have in those parts; when after they came down into the valley, and found the intolerable heats which are there, and knew no means of lighter apparel, they were forced to begin the custom of going naked, which continueth at this day. Only they take great pride and delight in the feathers of birds, and this also they took from those their ancestors of the mountains, who were invited unto it by the infinite flights of birds that came up to the high grounds, while the waters stood below. So you see, by this main accident of time, we lost our traffic with the Americans, with whom of all others, in regard they

lay nearest to us, we had most commerce. As for the other parts of the world, it is most manifest that in the ages following (whether it were in respect of wars, or by a natural revolution of time,) navigation did every where greatly decay; and specially far voyages (the rather by the use of galleys,[1] and such vessels as could hardly brook the ocean,) were altogether left and omitted. So then, that part of intercourse[2] which could be from other nations to sail to us, you see how it hath long since ceased; except it were by some rare accident, as this of yours. But now of the cessation of that other part of intercourse, which might be by our sailing to other nations, I must yield you some other cause. For I cannot say (if I shall say truly,) but our shipping, for number, strength, mariners, pilots, and all things that appertain to navigation, is as great as ever: and therefore why we should sit at home, I shall now give you an account by itself: and it will draw nearer to give you satisfaction to your principal question.

"There reigned in this island, about nineteen hundred years ago, a King, whose memory of all others we most adore; not superstitiously, but as a divine instrument, though a mortal man; his name was Solamona: and we esteem him as the lawgiver of our nation. This king had a *large heart*, inscrutable for good; and was wholly bent to make his kingdom and people happy. He therefore, taking into consideration how sufficient and substantive this land was to maintain itself without any aid at all of the foreigner; being five thousand six hundred miles in circuit, and

[1] *propterea quod triremes . . . in usum venire cœperunt.*
[2] *entercourse* in orig.

of rare fertility of soil in the greatest part thereof; and finding also the shipping of this country might be plentifully set on work, both by fishing and by transportations from port to port, and likewise by sailing unto some small islands that are not far from us, and are under the crown and laws of this state; and recalling into his memory the happy and flourishing estate wherein this land then was, so as it might be a thousand ways altered to the worse, but scarce any one way to the better; thought nothing wanted to his noble and heroical intentions, but only (as far as human foresight might reach) to give perpetuity to that which was in his time so happily established. Therefore amongst his other fundamental laws of this kingdom, he did ordain the interdicts and prohibitions which we have touching entrance of strangers; which at that time (though it was after the calamity of America) was frequent; doubting novelties, and commixture of manners. It is true, the like law against the admission of strangers without licence is an ancient law in the kingdom of China, and yet continued in use. But there it is a poor thing; and hath made them a curious, ignorant, fearful, foolish nation. But our lawgiver made his law of another temper. For first, he hath preserved all points of humanity, in taking order and making provision for the relief of strangers distressed; whereof you have tasted." At which speech (as reason was) we all rose up, and bowed ourselves. He went on. "That king also, still desiring to join humanity and policy together; and thinking it against humanity to detain strangers here against their wills, and against policy that they should return and discover their knowledge of this estate, he took this course: he did ordain

that of the strangers that should be permitted to land, as many (at all times) might depart as would; but as many as would stay should have very good conditions and means to live from the state. Wherein he saw so far, that now in so many ages since the prohibition, we have memory not of one ship that ever returned; and but of thirteen persons only, at several times, that chose to return in our bottoms. What those few that returned may have reported abroad I know not. But you must think, whatsoever they have said could be taken where they came but for a dream. Now for our travelling from hence into parts abroad, our Lawgiver thought fit altogether to restrain it. So is it not in China. For the Chinese sail where they will or can; which sheweth that their law of keeping out strangers is a law of pusillanimity and fear. But this restraint of ours hath one only exception, which is admirable; preserving the good which cometh by communicating with strangers, and avoiding the hurt; and I will now open it to you. And here I shall seem a little to digress, but you will by and by find it pertinent. Ye shall understand (my dear friends) that amongst the excellent acts of that king, one above all hath the pre-eminence. It was the erection and institution of an Order or Society which we call *Salomon's House;* the noblest foundation (as we think) that ever was upon the earth; and the lanthorn of this kingdom. It is dedicated to the study of the Works and Creatures of God. Some think it beareth the founder's name a little corrupted, as if it should be Solamona's House. But the records write it as it is spoken. So as I take it to be denominate of the King of the Hebrews, which is famous with you, and no stranger to us. For we

have some parts of his works which with you are lost; namely, that Natural History which he wrote, of all plants, from the *cedar of Libanus* to the *moss that groweth out of the wall*, and of all *things that have life and motion*. This maketh me think that our king, finding himself to symbolize in many things with that king of the Hebrews (which lived many years before him), honoured him with the title of this foundation.[1] And I am the rather induced to be of this opinion, for that I find in ancient records this Order or Society is sometimes called Salomon's House, and sometimes the College of the Six Days Works; whereby I am satisfied that our excellent king had learned from the Hebrews that God had created the world and all that therein is within six days; and therefore he instituting that House for the finding out of the true nature of all things,[2] (whereby God might have the more glory in the workmanship of them, and men the more fruit in the use of them,) did give it also that second name. But now to come to our present purpose. When the king had forbidden to all his people navigation into any part that was not under his crown, he made nevertheless this ordinance; That every twelve years there should be set forth out of this kingdom two ships, appointed to

[1] Bacon in speaking of this king who symbolizes with Solomon seems to allude to James I. — *R. L. E.* [If the *New Atlantis* had been written in the earlier part of James's reign, Bacon might have been suspected perhaps of some such allusion. He might have hoped to encourage James to justify the parallel by going and doing likewise. But since James had now reigned above twenty years without doing or attempting to do anything for the furtherance of Natural Philosophy; without showing any interest in it or any taste or capacity for it; I cannot understand what the allusion can be or where the resemblance. Nor does it seem necessary to suppose anything of the kind in order to explain why a model-king for wisdom and knowledge should be likened to Solomon. — *J. S.*]

[2] *ad inquisitionem et inventionem naturæ veræ et interioris rerum omnium.*

several voyages; That in either of these ships there should be a mission of three of the Fellows or Brethren of Salomon's House; whose errand was only to give us knowledge of the affairs and state of those countries to which they were designed, and especially of the sciences, arts, manufactures, and inventions of all the world; and withal to bring unto us books, instruments, and patterns in every kind; That the ships, after they had landed the brethren, should return; and that the brethren should stay abroad till the new mission. These ships are not otherwise fraught, than with store of victuals, and good quantity of treasure to remain with the brethren, for the buying of such things and rewarding of such persons as they should think fit. Now for me to tell you how the vulgar sort of mariners are contained from being discovered at land; and how they that must be put on shore for any time, colour themselves under the names of other nations; and to what places these voyages have been designed; and what places of *rendez-vous* are appointed for the new missions; and the like circumstances of the practique; I may not do it: neither is it much to your desire. But thus you see we maintain a trade, not for gold, silver, or jewels; nor for silks; nor for spices; nor any other commodity of matter; but only for God's first creature, which was *Light*: to have *light* (I say) of the growth of all parts of the world." [1] And when he had said this, he was silent; and so were we all. For indeed we were all astonished to hear so strange things so probably told. And he, perceiving that we were willing to say somewhat but

[1] *i. e.*, in whatever parts of the world it is to be found. *Luce, inquam, in quacunque tandem terræ regione prorumpente et germinante.*

had it not ready, in great courtesy took us off, and descended to ask us questions of our voyage and fortunes; and in the end concluded, that we might do well to think with ourselves what time of stay we would demand of the state; and bade us not to scant ourselves; for he would procure such time as we desired. Whereupon we all rose up, and presented ourselves to kiss the skirt of his tippet; but he would not suffer us; and so took his leave. But when it came once amongst our people that the state used to offer conditions to strangers that would stay, we had work enough to get any of our men to look to our ship, and to keep them from going presently to the governor to crave conditions. But with much ado we refrained them, till we might agree what course to take.

We took ourselves now for free men, seeing there was no danger of our utter perdition; and lived most joyfully, going abroad and seeing what was to be seen in the city and places adjacent within our tedder; and obtaining acquaintance with many of the city, not of the meanest quality; at whose hands we found such humanity, and such a freedom and desire to take strangers as it were into their bosom, as was enough to make us forget all that was dear to us in our own countries: and continually we met with many things right worthy of observation and relation; as indeed, if there be a mirror in the world worthy to hold men's eyes, it is that country. One day there were two of our company bidden to a Feast of the Family, as they call it. A most natural, pious, and reverend custom it is, shewing that nation to be compounded of all goodness. This is the manner of it. It is granted to

any man that shall live to see thirty persons descended of his body alive together, and all above three years old, to make this feast; which is done at the cost of the state. The Father of the Family, whom they call the *Tirsan*, two days before the feast, taketh to him three of such friends as he liketh to choose; and is assisted also by the governor of the city or place where the feast is celebrated; and all the persons of the family, of both sexes, are summoned to attend him. These two days the Tirsan sitteth in consultation concerning the good estate of the family. There, if there be any discord or suits between any of the family, they are compounded and appeased. There, if any of the family be distressed or decayed, order is taken for their relief and competent means to live. There, if any be subject to vice, or take ill courses, they are reproved and censured. So likewise direction is given touching marriages, and the courses of life which any of them should take, with divers other the like orders and advices. The governor assisteth, to the end to put in execution by his public authority the decrees and orders of the Tirsan, if they should be disobeyed; though that seldom needeth; such reverence and obedience they give to the order of nature. The Tirsan doth also then ever choose one man from amongst his sons, to live in house with him: who is called ever after the Son of the Vine. The reason will hereafter appear. On the feast-day, the Father or Tirsan cometh forth after divine service into a large room where the feast is celebrated; which room hath an half-pace[1] at the upper end. Against the wall, in the

[1] Half-pace or dais, the part raised by a low step above the rest of the floor. — *R. L. E.*

middle of the half-pace, is a chair placed for him, with a table and carpet before it. Over the chair is a state,[1] made round or oval, and it is of ivy; an ivy somewhat whiter than ours, like the leaf of a silver asp, but more shining; for it is green all winter. And the state is curiously wrought with silver and silk of divers colours, broiding or binding in the ivy; and is ever of the work of some of the daughters of the family; and veiled over at the top with a fine net of silk and silver. But the substance of it is true ivy; whereof, after it is taken down, the friends of the family are desirous to have some leaf or sprig to keep. The Tirsan cometh forth with all his generation or lineage,[2] the males before him, and the females following him; and if there be a mother from whose body the whole lineage is descended, there is a traverse placed in a loft above on the right hand of the chair, with a privy door, and a carved window of glass, leaded with gold and blue; where she sitteth, but is not seen. When the Tirsan is come forth, he sitteth down in the chair; and all the lineage place themselves against the wall, both at his back and upon the return of the half-pace,[3] in order of their years without difference of sex; and stand upon their feet. When he is set; the room being always full of company, but well kept and without disorder; after some pause there cometh in from the lower end of the room a *Taratan* (which is as much as an herald) and on either side of

[1] *i. e.* a canopy, *conopeum.*

[2] *linage* in the original; which seems to be the proper form of the word. The *e* may have been introduced originally as a direction for the lengthening of the first syllable; and then the resemblance of the word to such words as *lineal* may have suggested the modern pronunciation.

[3] *juxta parietem, tam a tergo quam a lateribus aulæ, super gradum ascensûs.*

him two young lads; whereof one carrieth a scroll of their shining yellow parchment; and the other a cluster of grapes of gold, with a long foot or stalk. The herald and children are clothed with mantles of sea-water green sattin; but the herald's mantle is streamed with gold, and hath a train. Then the herald with three curtesies, or rather inclinations, cometh up as far as the half-pace; and there first taketh into his hand the scroll. This scroll is the King's Charter, containing gift of revenew, and many privileges, exemptions, and points of honour, granted to the Father of the Family; and is ever styled and directed, *To such an one our well-beloved friend and creditor:* which is a title proper only to this case. For they say the king is debtor to no man, but for propagation of his subjects. The seal set to the king's charter is the king's image, imbossed or moulded in gold; and though such charters be expedited of course, and as of right, yet they are varied by discretion, according to the number and dignity of the family. This charter the herald readeth aloud; and while it is read, the father or Tirsan standeth up, supported by two of his sons, such as he chooseth. Then the herald mounteth the half-pace, and delivereth the charter into his hand: and with that there is an acclamation by all that are present in their language, which is thus much: *Happy are the people of Bensalem.* Then the herald taketh into his hand from the other child the cluster of grapes, which is of gold, both the stalk and the grapes. But the grapes are daintily enamelled; and if the males of the family be the greater number, the grapes are enamelled purple, with a little sun set on the top; if the females, then they are enamelled into a greenish yellow, with a

crescent on the top. The grapes are in number as many as there are descendants of the family. This golden cluster the herald delivereth also to the Tirsan; who presently delivereth it over to that son that he had formerly chosen to be in house with him: who beareth it before his father as an ensign of honour when he goeth in public, ever after; and is thereupon called the Son of the Vine. After this ceremony ended, the father or Tirsan retireth; and after some time cometh forth again to dinner, where he sitteth alone under the state, as before; and none of his descendants sit with him, of what degree or dignity soever, except he hap to be of Salomon's House. He is served only by his own children, such as are male; who perform unto him all service of the table upon the knee; and the women only stand about him, leaning against the wall. The room below the half-pace hath tables on the sides for the guests that are bidden; who are served with great and comely order; and towards the end of dinner (which in the greatest feasts with them lasteth never above an hour and an half) there is an hymn sung, varied according to the invention of him that composeth it, (for they have excellent poesy,) but the subject of it is (always) the praises of Adam and Noah and Abraham; whereof the former two peopled the world, and the last was the Father of the Faithful: concluding ever with a thanksgiving for the nativity of our Saviour, in whose birth the births of all are only blessed. Dinner being done, the Tirsan retireth again; and having withdrawn himself alone into a place where he maketh some private prayers, he cometh forth the third time, to give the blessing; with all his descendants, who stand about him as at the first. Then he

calleth them forth by one and by one, by name, as he pleaseth, though seldom the order of age be inverted. The person that is called (the table being before removed) kneeleth down before the chair, and the father layeth his hand upon his head, or her head, and giveth the blessing in these words: *Son of Bensalem*, (*or Daughter of Bensalem*,) *thy father saith it: the man by whom thou hast breath and life speaketh the word: The blessing of the everlasting Father, the Prince of Peace, and the Holy Dove be upon thee, and make the days of thy pilgrimage good and many.* This he saith to every of them; and that done, if there be any of his sons of eminent merit and virtue, (so they be not above two,) he calleth for them again; and saith, laying his arm over their shoulders, they standing; *Sons, it is well ye are born, give God the praise, and persevere to the end.* And withal delivereth to either of them a jewel, made in the figure of an ear of wheat, which they ever after wear in the front of their turban or hat. This done, they fall to music and dances, and other recreations, after their manner, for the rest of the day. This is the full order of that feast.

By that time six or seven days were spent, I was fallen into strait acquaintance with a merchant of that city, whose name was Joabin. He was a Jew, and circumcised: for they have some few stirps of Jews yet remaining among them, whom they leave to their own religion. Which they may the better do, because they are of a far differing disposition from the Jews in other parts. For whereas they hate the name of Christ, and have a secret inbred rancour against the people amongst whom they live: these (contrariwise) give unto our Saviour many high attributes, and love the nation

of Bensalem extremely. Surely this man of whom I speak would ever acknowledge that Christ was born of a Virgin, and that he was more than a man; and he would tell how God made him ruler of the Seraphims which guard his throne; and they call him also the *Milken Way*, and the *Eliah* of the *Messiah;* and many other high names; which though they be inferior to his divine Majesty, yet they are far from the language of other Jews. And for the country of Bensalem, this man would make no end of commending it: being desirous, by tradition among the Jews there, to have it believed that the people thereof were of the generations of Abraham, by another son, whom they call Nachoran; and that Moses by a secret cabala ordained the laws of Bensalem which they now use; and that when the Messiah should come, and sit in his throne at Hierusalem, the king of Bensalem should sit at his feet, whereas other kings should keep a great distance. But yet setting aside these Jewish dreams, the man was a wise man, and learned, and of great policy, and excellently seen in the laws and customs of that nation. Amongst other discourses, one day I told him I was much affected with the relation I had from some of the company, of their custom in holding the Feast of the Family; for that (methought) I had never heard of a solemnity wherein nature did so much preside. And because propagation of families proceedeth from the nuptial copulation, I desired to know of him what laws and customs they had concerning marriage; and whether they kept marriage well; and whether they were tied to one wife? For that where population is so much affected, and such as with them it seemed to be, there is commonly permission of plu-

rality of wives. To this he said, "You have reason for to commend that excellent institution of the Feast of the Family. And indeed we have experience, that those families that are partakers of the blessing of that feast do flourish and prosper ever after in an extraordinary manner. But hear me now, and I will tell you what I know. You shall understand that there is not under the heavens so chaste a nation as this of Bensalem; nor so free from all pollution or foulness. It is the virgin of the world. I remember I have read in one of your European books, of an holy hermit amongst you that desired to see the Spirit of Fornication; and there appeared to him a little foul ugly Æthiop.[1] But if he had desired to see the Spirit of Chastity of Bensalem, it would have appeared to him in the likeness of a fair beautiful Cherubin. For there is nothing amongst mortal men more fair and admirable, than the chaste minds of this people. Know therefore, that with them there are no stews, no dissolute houses, no courtesans, nor anything of that kind. Nay they wonder (with detestation) at you in Europe, which permit such things. They say ye have put marriage out of office: for marriage is ordained a remedy for unlawful concupiscence; and natural concupiscence seemeth as a spur to marriage. But when men have at hand a remedy more agreeable to their corrupt will, marriage is almost expulsed. And therefore there are with you seen infinite men that marry not, but chuse rather a libertine and impure single life, than to be yoked in marriage; and many that do marry, marry late, when the prime and strength of their years is past. And when they do marry, what is marriage to them but a

[1] The Klein Meister of La Motte Fouqué's *Sintram*. — *R. L. E.*

very bargain; wherein is sought alliance, or portion, or reputation, with some desire (almost indifferent) of issue; and not the faithful nuptial union of man and wife, that was first instituted. Neither is it possible that those that have cast away so basely so much of their strength, should greatly esteem children, (being of the same matter,[1]) as chaste men do. So likewise during marriage, is the case much amended, as it ought to be if those things were tolerated only for necessity? No, but they remain still as a very affront to marriage. The haunting of those dissolute places, or resort to courtesans, are no more punished in married men than in bachelors. And the depraved custom of change, and the delight in meretricious embracements, (where sin is turned into art,)[2] maketh marriage a dull thing, and a kind of imposition or tax. They hear you defend these things, as done to avoid greater evils; as advoutries, deflouring of virgins, unnatural lust, and the like. But they say this is a preposterous wisdom; and they call it *Lot's offer*, who to save his guests from abusing, offered his daughters: nay they say farther that there is little gained in this; for that the same vices and appetites do still remain and abound; unlawful lust being like a furnace, that if you stop the flames altogether, it will quench; but if you give it any vent, it will rage. As for masculine love, they have no touch of it;[3] and yet there are not so faithful and inviolate friendships in the world again as are there; and to speak generally, (as I said before,) I have not

[1] *liberi* (*pars nostri altera*).

[2] Non v' era giunto ancor Sardanapalo
A mostrar cio ch' in camera si puote.
DANTE, *Paradiso*, xiv.—*R. L. E.*

[3] *istos ne fando quidem norunt.*

read of any such chastity in any people as theirs. And their usual saying is, *That whosoever is unchaste cannot reverence himself;* and they say, *That the reverence of a man's self is, next religion, the chiefest bridle of all vices.*" And when he had said this, the good Jew paused a little; whereupon I, far more willing to hear him speak on than to speak myself, yet thinking it decent that upon his pause of speech I should not be altogether silent, said only this; "That I would say to him, as the widow of Sarepta said to Elias; that he was come to bring to memory our sins; and that I confess the righteousness of Bensalem was greater than the righteousness of Europe." At which speech he bowed his head, and went on in this manner: "They have also many wise and excellent laws touching marriage. They allow no polygamy. They have ordained that none do intermarry or contract, until a month be passed from their first interview. Marriage without consent of parents they do not make void, but they mulct it in the inheritors: for the children of such marriages are not admitted to inherit above a third part of their parents' inheritance. I have read in a book of one of your men, of a Feigned Commonwealth, where the married couple are permitted, before they contract, to see one another naked.[1] This they dislike; for they think it a scorn to give a refusal after so familiar knowledge: but because of many hidden defects in men and women's bodies,[2] they have a more civil way; for they have near every town a couple of pools, (which they call *Adam and Eve's pools*,) where it is permitted to one of the friends of the man, and

[1] See More's Utopia, book ii. — *R. L. E.*

[2] The translation adds *qui matrimonium postea infelix reddere possint.*

another of the friends of the woman, to see them severally bathe naked."

And as we were thus in conference, there came one that seemed to be a messenger, in a rich huke,[1] that spake with the Jew: whereupon he turned to me and said; "You will pardon me, for I am commanded away in haste." The next morning he came to me again, joyful as it seemed, and said, "There is word come to the governor of the city, that one of the Fathers of Salomon's House will be here this day sevennight: we have seen none of them this dozen years. His coming is in state; but the cause of his coming is secret. I will provide you and your fellows of a good standing to see his entry." I thanked him, and told him, "I was most glad of the news." The day being come, he made his entry. He was a man of middle stature and age, comely of person, and had an aspect as if he pitied men. He was clothed in a robe of fine black cloth, with wide sleeves and a cape. His under garment was of excellent white linen down to the foot, girt with a girdle of the same; and a sindon or tippet of the same about his neck. He had gloves that were curious, and set with stone; and shoes of peach-coloured velvet. His neck was bare to the shoulders. His hat was like a helmet, or Spanish Montera; and his locks curled below it decently: they were of colour brown. His beard was cut round, and of the same colour with his hair, somewhat lighter.[2] He was carried in a rich chariot without wheels, litter-wise; with two horses at either end, richly trapped in blue velvet embroidered; and two footmen on each

[1] *indutus tunicâ pictâ et inauratâ.*

[2] The words "somewhat lighter" are omitted in the translation.

side in the like attire. The chariot was all of cedar, gilt, and adorned with crystal; save that the fore-end had pannels of sapphires, set in borders of gold, and the hinder-end the like of emeralds[1] of the Peru colour. There was also a sun of gold, radiant, upon the top, in the midst;[2] and on the top before, a small cherub of gold, with wings displayed. The chariot was covered with cloth of gold tissued upon blue. He had before him fifty attendants, young men all, in white sattin loose coats to the mid-leg; and stockings of white silk; and shoes of blue velvet; and hats of blue velvet; with fine plumes of divers colours, set round like hat-bands. Next before the chariot went two men, bare-headed, in linen garments down the foot, girt, and shoes of blue velvet; who carried the one a crosier, the other a pastoral staff like a sheep-hook; neither of them of metal, but the crosier of balm-wood, the pastoral staff of cedar. Horsemen he had none, neither before nor behind his chariot: as it seemeth, to avoid all tumult and trouble. Behind his chariot went all the officers and principals of the Companies of the City. He sat alone, upon cushions of a kind of excellent plush, blue; and under his foot curious carpets of silk of divers colours, like the Persian, but far finer. He held up his bare hand as he went, as blessing the people, but in silence. The street was wonderfully well kept:[3] so that there was never any army had their men stand in better battle-array, than the people stood. The windows likewise were not crowded, but

[1] *emerauds* in orig.

[2] *Etiam in medio verticis cathedræ, sol erat, ex auro radians.* The English in the original has a comma after "gold," and no stop after "radiant;" a misprint probably.

[3] *Plateæ ita erant ordinatæ ut via ampla pateret, nullibi interclusa.*

every one stood in them as if they had been placed. When the shew was past, the Jew said to me; "I shall not be able to attend you[1] as I would, in regard of some charge the city hath laid upon me, for the entertaining of this great person." Three days after, the Jew came to me again, and said; "Ye are happy men; for the Father of Salomon's House taketh knowledge of your being here, and commanded me to tell you that he will admit all your company to his presence, and have private conference with one of you that ye shall choose: and for this hath appointed the next day after to-morrow. And because he meaneth to give you his blessing, he hath appointed it in the forenoon." We came at our day and hour, and I was chosen by my fellows for the private access. We found him in a fair chamber, richly hanged, and carpeted under foot, without any degrees to the state. He was set upon a low throne richly adorned, and a rich cloth of state over his head, of blue sattin embroidered. He was alone, save that he had two pages of honour, on either hand one, finely attired in white. His under-garments were the like that we saw him wear in the chariot; but instead of his gown, he had on him a mantle with a cape, of the same fine black, fastened about him. When we came in, as we were taught, we bowed low at our first entrance; and when we were come near his chair, he stood up, holding forth his hand ungloved, and in posture of blessing; and we every one of us stooped down, and kissed the hem of his tippet. That done, the rest departed, and I remained. Then he warned the pages forth of the room, and caused me to sit down beside him, and spake to me thus in the Spanish tongue:

[1] *Per aliquot jam dies detinebor, quò minus, &c.*

"God bless thee, my son; I will give thee the greatest jewel I have. For I will impart unto thee, for the love of God and men, a relation of the true state of Salomon's House. Son, to make you know the true state of Salomon's House, I will keep this order. First, I will set forth unto you the end of our foundation. Secondly, the preparations and instruments we have for our works. Thirdly, the several employments and functions whereto our fellows are assigned. And fourthly, the ordinances and rites which we observe.

"The End of our Foundation is the knowledge of Causes, and secret motions of things;[1] and the enlarging of the bounds of Human Empire, to the effecting of all things possible.

"The Preparations and Instruments are these. We have large and deep caves of several depths: the deepest are sunk six hundred fathom; and some of them are digged and made under great hills and mountains: so that if you reckon together the depth of the hill and the depth of the cave, they are (some of them) above three miles deep. For we find that the depth of a hill, and the depth of a cave from the flat, is the same thing; both remote alike from the sun and heaven's beams, and from the open air. These caves we call the Lower Region. And we use them for all coagulations, indurations, refrigerations, and conservations of bodies. We use them likewise for the imitation of natural mines; and the producing also of new artificial metals, by compositions and materials which we use,[2]

[1] *et motuum, ac virtutum interiorum in Natura.*

[2] *quæ ibi præparamus.*

and lay there for many years. We use them also sometimes, (which may seem strange,) for curing of some diseases, and for prolongation of life in some hermits that choose to live there, well accommodated of all things necessary; and indeed live very long; by whom also we learn many things.

"We have burials in several earths,[1] where we put divers cements, as the Chineses do their porcellain. But we have them in greater variety, and some of them more fine. We have also great variety of composts, and soils,[2] for the making of the earth fruitful.

"We have high towers; the highest about half a mile in height; and some of them likewise set upon high mountains; so that the vantage of the hill with the tower is in the highest of them three miles at least. And these places we call the Upper Region: accounting the air between the high places and the low, as a Middle Region. We use these towers, according to their several heights and situations, for insolation, refrigeration, conservation; and for the view of divers meteors; as winds, rain, snow, hail; and some of the fiery meteors also. And upon them, in some places, are dwellings of hermits, whom we visit sometimes, and instruct what to observe.

"We have great lakes both salt and fresh, whereof we have use for the fish and fowl.[3] We use them also for burials of some natural bodies: for we find a difference in things buried in earth or in air below the earth, and things buried in water. We have also

[1] *Habemus etiam alias sepulturas corporum naturalium et materiarum; non in concavo aliquo, sed in ipsa terrâ contiguâ, ubi complura cæmenta condimus, &c.*

[2] *stercorationum et fimorum varietatem magnam, item congestionum et massarum aliarum, &c.*

[3] *aves item palustres et aquaticas, omnis generis.*

pools, of which some do strain fresh water out of salt; and others by art do turn fresh water into salt. We have also some rocks in the midst of the sea, and some bays[1] upon the shore, for some works wherein is required the air and vapour of the sea. We have likewise violent streams and cataracts, which serve us for many motions:[2] and likewise engines for multiplying and enforcing of winds, to set also on going divers motions.[3]

"We have also a number of artificial wells and fountains, made in imitation of the natural sources and baths; as tincted upon vitriol, sulphur, steel, brass, lead, nitre, and other minerals. And again we have little wells for infusions of many things, where the waters take the virtue[4] quicker and better than in vessels or basons. And amongst them we have a water which we call Water of Paradise, being, by that we do to it, made very sovereign for health, and prolongation of life.

"We have also great and spacious houses, where we imitate and demonstrate[5] meteors; as snow, hail, rain, some artificial rains of bodies and not of water, thunders, lightnings;[6] also generations of bodies in air; as frogs, flies, and divers others.

"We have also certain chambers, which we call Chambers of Health, where we qualify the air as we think good and proper for the cure of divers diseases, and preservation of health.[7]

[1] *loca quædam aprica.* [2] *motuum violentorum.*

[3] *quæ ventos excipiant, multiplicent, et roborent.*

[4] *ubi aqua (currens scilicet) virtutem corporum melius et vivacius, &c.*

[5] *i. e.* exhibit: *in quibus imitamenta et repræsentationes meteororum exhibemus.*

[6] The translation adds *coruscationum.*

[7] This experiment has been tried, especially by Dr. Beddoes of Clifton,

"We have also fair and large baths, of several mixtures, for the cure of diseases, and the restoring of man's body from arefaction: and others for the confirming of it in strength of sinews, vital parts, and the very juice and substance of the body.

"We have also large and various orchards and gardens, wherein we do not so much respect beauty, as variety of ground and soil, proper for divers trees and herbs: and some very spacious, where trees and berries are set whereof we make divers kinds of drinks, besides the vineyards. In these we practise likewise all conclusions of grafting and inoculating, as well of wild-trees as fruit-trees, which produceth many effects. And we make (by art) in the same orchards and gardens, trees and flowers to come earlier or later than their seasons; and to come up and bear more speedily than by their natural course they do. We make them also by art greater much than their nature; and their fruit greater and sweeter and of differing taste, smell, colour, and figure, from their nature. And many of them we so order, as they become of medicinal use.

"We have also means to make divers plants rise by mixtures of earths without seeds; and likewise to make divers new plants, differing from the vulgar; and to make one tree or plant turn into another.

"We have also parks and inclosures of all sorts of beasts and birds, which we use not only for view or rareness, but likewise for dissections and trials; that thereby we may take light what may be wrought upon the body of man. Wherein we find many strange ef-

but without any marked result. Some relief has been obtained in cases of phthisis by inhaling oxygenated air. — *R. L. E.*

fects; as continuing life in them, though divers parts, which you account vital, be perished and taken forth; resuscitating of some that seem dead in appearance; and the like. We try also all poisons and other medicines upon them, as well of chirurgery as physic.[1] By art likewise, we make them greater or taller than their kind is; and contrariwise dwarf them, and stay their growth: we make them more fruitful and bearing than their kind is; and contrariwise barren and not generative. Also we make them differ in colour, shape, activity, many ways. We find means to make commixtures and copulations of different kinds; which have produced many new kinds, and them not barren, as the general opinion is. We make a number of kinds of serpents, worms, flies, fishes, of putrefaction; whereof some are advanced (in effect) to be perfect creatures, like beasts or birds; and have sexes, and do propagate. Neither do we this by chance, but we know beforehand of what matter and commixture what kind of those creatures will arise.[2]

"We have also particular pools, where we make trials upon fishes, as we have said before of beasts and birds.

"We have also places for breed and generation of those kinds of worms and flies which are of special use; such as are with you your silk-worms and bees.

[1] The translation adds *ut corpori humano melius caveamus.*

[2] This passage is quoted with great approbation by Geoffroi St. Hilaire at the end of a memoir on the results of artificial incubation read before the Academy of Sciences in 1826, and published in the *Annales du Museum* for that year. It may be said that he was the first by whom the scientific importance of monstrosities was fully appreciated, and in answer to the objections which were made to the study of Teratology on the ground of its inutility, he invokes the authority of Bacon. — *R. L. E.*

"I will not hold you long with recounting of our brew-houses, bake-houses, and kitchens, where are made divers drinks, breads, and meats, rare and of special effects. Wines we have of grapes; and drinks of other juice of fruits, of grains, and of roots:[1] and of mixtures with honey, sugar, manna, and fruits dried and decocted. Also of the tears or woundings of trees, and of the pulp of canes. And these drinks are of several ages, some to the age or last of forty years. We have drinks also brewed with several herbs, and roots, and spices; yea with several fleshes, and white meats;[2] whereof some of the drinks are such, as they are in effect meat and drink both:[3] so that divers, especially in age, do desire to live with them, with little or no meat or bread. And above all, we strive to have drinks of extreme thin parts, to insinuate into the body, and yet without all biting, sharpness, or fretting; insomuch as some of them put upon the back of your hand will, with a little stay, pass through to the palm, and yet taste mild to the mouth. We have also waters which we ripen in that fashion, as they become nourishing; so that they are indeed excellent drink; and many will use no other. Breads we have of several grains, roots, and kernels: yea and some of flesh and fish dried; with divers kinds of leavenings and seasonings: so that some do extremely move appetites; some do nourish so, as divers do live of them, without any other meat; who live very long. So for meats, we

[1] *decoctionibus granorum et radicum.*

[2] *quin et additis quandoque carnibus, ovis, lacticiniis, et aliis esculentis.*

[3] Chocolate, which however was well known in Bacon's time, seems to fulfil this description. It long since gave rise to a doubt whether drinking it amounted to breaking fast. See the treatise of the Jesuit Hurtado, "Utrum potio chocolatica frangat jejunium Ecclesiæ."—*R. L. E.*

have some of them so beaten and made tender and mortified, yet without all corrupting, as a weak heat of the stomach will turn them into good chylus, as well as a strong heat would meat otherwise prepared. We have some meats also and breads and drinks, which taken by men enable them to fast long after; and some other, that used make the very flesh of men's bodies sensibly more hard and tough, and their strength far greater than otherwise it would be.

"We have dispensatories, or shops of medicines. Wherein you may easily think, if we have such variety of plants and living creatures more than you have in Europe, (for we know what you have,) the simples, drugs, and ingredients of medicines, must likewise be in so much the greater variety. We have them likewise of divers ages, and long fermentations. And for their preparations,[1] we have not only all manner of exquisite distillations and separations, and especially by gentle heats and percolations through divers strainers, yea and substances;[2] but also exact forms of composition, whereby they incorporate almost, as they were natural simples.

"We have also divers mechanical arts, which you have not; and stuffs made by them; as papers, linen, silks, tissues; dainty works of feathers of wonderful lustre; excellent dyes, and many others; and shops likewise,[3] as well for such as are not brought into vulgar use amongst us as for those that are. For you must know that of the things before recited, many of

[1] *medicinarum præparationes.*

[2] *per diversa lintea, lanea, ligna, imò et substantias solidiores.*

[3] *officinas etiam aliquarum artium prædictarum.*

them are grown into use throughout the kingdom; but yet if they did flow from our invention, we have of them also for patterns and principals.[1]

"We have also furnaces of great diversities, and that keep great diversity of heats; fierce and quick; strong and constant; soft and mild; blown, quiet; dry, moist; and the like. But above all, we have heats in imitation of the sun's and heavenly bodies' heats, that pass divers inequalities and (as it were) orbs, progresses, and returns, whereby we produce admirable effects. Besides, we have heats[2] of dungs, and of bellies and maws of living creatures, and of their bloods and bodies; and of hays and herbs laid up moist; of lime unquenched; and such like. Instruments also which generate heat only by motion.[3] And farther, places for strong insolations; and again, places under the earth, which by nature or art yield heat. These divers heats we use, as the nature of the operation which we intend requireth.

"We have also perspective-houses, where we make demonstrations of all lights and radiations; and of all colours; and out of things uncoloured and transparent, we can represent unto you all several colours; not in rain-bows,[4] as it is in gems and prisms, but of themselves single.[5] We represent also all multiplications of light, which we carry to great distance, and make so sharp as to discern small points and lines; also all colorations of light: all delusions and deceits of the

[1] *earum quandoque exemplaria, tanquam primigenia, et optimè elaborata, in Domo nostrâ retinemus.*

[2] *imitationes caloris.*

[3] Bacon seems to refer to the result of his investigation into the form of heat, namely that heat is a kind of motion. — *R. L. E.*

[4] *non in formâ iridum yliscentes.* [5] *sed per se simplices et constantes.*

sight, in figures, magnitudes, motions, colours: all demonstrations of shadows.[1] We find also divers means, yet unknown to you, of producing of light originally from divers bodies. We procure means of seeing objects afar off; as in the heaven and remote places; and represent things near as afar off, and things afar off as near; making feigned distances. We have also helps for the sight, far above spectacles and glasses in use.[2] We have also glasses and means[3] to see small and minute bodies perfectly and distinctly; as the shapes and colours of small flies and worms, grains and flaws in gems, which cannot otherwise be seen; observations in urine[4] and blood, not otherwise to be seen.[5] We make artificial rain-bows, halos, and circles about light.[6] We represent also all manner of reflexions, refractions, and multiplications of visual beams of objects.

"We have also precious stones of all kinds, many of them of great beauty, and to you unknown; crystals likewise; and glasses of divers kinds; and amongst them some of metals vitrificated, and other materials besides those of which you make glass. Also a num-

[1] *umbrarum et imaginum in aëre volitantium.*

[2] *quæ bisoculis vestris et speculis, usu longe præstant.*

[3] *artificia.*

[4] It has been proposed to facilitate the examination of diabetic urine by an apparatus in which the amount of sugar present in it is to be measured by its effect on the plane of polarisation of polarised light transmitted through it. — *R. L. E.*

[5] Nothing that has been accomplished with the microscope would have interested Bacon more than the discoveries of Schleiden and Schwann, because nothing has brought us so near the latens processus by which the tissues of organic life are formed. It is remarkable that when Schleiden had as he conceived destroyed the analogy between the developments of vegetable and animal life, by showing that all vegetable tissues are developed by cells, Schwann should have re-established it more clearly than before by showing that this is true of all animal tissues also. — *R. L. E.*

[6] *halones, circulos, vibrationes et trepidationes luminis.*

ber of fossils, and imperfect minerals, which you have not. Likewise loadstones of prodigious virtue; and other rare stones, both natural and artificial.

"We have also sound-houses, where we practise and demonstrate all sounds, and their generation. We have harmonies which you have not, of quarter-sounds, and lesser slides of sounds.[1] Divers instruments of music likewise to you unknown, some sweeter than any you have; together with bells and rings that are dainty and sweet. We represent small sounds as great and deep; likewise great sounds extenuate and sharp; we make divers tremblings and warblings of sounds, which in their original are entire. We represent and imitate all articulate sounds and letters, and the voices and notes of beasts and birds. We have certain helps which set to the ear do further the hearing greatly. We have also divers strange and artificial echos, reflecting the voice many times, and as it were tossing it: and some that give back the voice louder than it came; some shriller, and some deeper; yea, some rendering the voice differing in the letters or articulate sound from that they receive. We have also means to convey sounds in trunks and pipes, in strange lines and distances.[2]

"We have also perfume-houses; wherewith we join also practices of taste. We multiply smells, which may seem strange. We imitate smells, making all smells to breathe out of other mixtures than those that give them.[3] We make divers imitations of taste

[1] *miscentes non tantum* Beta *illud acutum et molle, ut vos, sed* quadrantes *sonorum; et sonos tremulos aliquos dulcissimos.*

[2] [*ad magnam distantiam, et in lineis tortuosis.*] This is now done very effectively by means of gutta percha tubing.— *R. L. E.*

[3] This power of imitating smells is one of the recent achievements of

likewise, so that they will deceive any man's taste. And in this house we contain also a confiture-house; where we make all sweet-meats, dry and moist,[1] and divers pleasant wines, milks, broths, and sallets, in far greater variety than you have.

"We have also engine-houses, where are prepared engines and instruments for all sorts of motions. There we imitate and practise to make swifter motions than any you have, either out of your muskets or any engine that you have; and to make them and multiply them more easily, and with small force,[2] by wheels and other means: and to make them stronger, and more violent than yours are; exceeding your greatest cannons and basilisks. We represent also ordnance and instruments of war, and engines of all kinds: and likewise new mixtures and compositions of gun-powder, wildfires burning in water, and unquenchable. Also fire-works of all variety both for pleasure and use. We imitate also flights of birds; we have some degrees of flying in the air;[3] we have ships and boats for going under water,[4] and brooking

chemistry. From fusil oil, a product of the distillation of spirits from potatoes, itself exceedingly offensive, may be got oil of apples, oil of pears, oil of grapes, and oil of cognac. The oil of pine-apples and that of bitter almonds enable confectioners to imitate perfectly the scent and flavour of pine-apples and bitter almonds respectively, and both, like the perfumes already mentioned, are got from very offensive substances. — *R. L. E.*

[1] The translation adds *imò et condimus ea cum rebus aliis dulcibus, gratissimis, præter saocharum et mel.*

[2] *motus reddere faciliores et intentiores, eos multiplicando per rotas et alios modos.*

[3] *gradus quosdam habemus et commoditates vecturæ per aërem instar animalium alatorum.*

[4] A boat for going under water was one of Drebbel's inventions exhibited in 1620. Bacon in the *De Augmentis* refers to another namely, Drebbel's method of producing cold. — *R. L. E.*

of seas; also swimming-girdles and supporters. We have divers curious clocks, and other like motions of return,[1] and some perpetual motions. We imitate also motions of living creatures, by images of men, beasts, birds, fishes, and serpents. We have also a great number of other various[2] motions, strange for equality, fineness, and subtilty.

"We have also a mathematical house, where are represented all instruments, as well of geometry as astronomy, exquisitely made.

"We have also houses of deceits of the senses; where we represent all manner of feats of juggling, false apparitions, impostures, and illusions; and their fallacies. And surely you will easily believe that we that have so many things truly natural which induce admiration, could in a world of particulars deceive the senses, if we would disguise those things and labour to make them seem more miraculous. But we do hate all impostures and lies: insomuch as we have severely forbidden it to all our fellows, under pain of ignominy and fines, that they do not shew any natural work or thing, adorned or swelling;[3] but only pure as it is, and without all affectation of strangeness.

"These are (my son) the riches of Salomon's House.

"For the several employments and offices of our fellows; we have twelve that sail into foreign countries, under the names of other nations, (for our own we conceal;) who bring us the books, and abstracts,

[1] *et alios motus aëris et aquarum, in orbem et per vices revertentes.*

[2] The word "various," which seems to be redundant, is omitted in the translation.

[3] *artificioso apparatu mentitum.*

and patterns of experiments of all other parts.[1] These we call Merchants of Light.

"We have three that collect the experiments which are in all books. These we call Depredators.

"We have three that collect the experiments of all mechanical arts; and also of liberal sciences; and also of practices which are not brought into arts. These we call Mystery-men.[2]

"We have three that try new experiments, such as themselves think good. These we call Pioners or Miners.

"We have three that draw the experiments of the former four into titles and tables, to give the better light for the drawing of observations and axioms out of them. These we call Compilers.[3]

"We have three that bend themselves, looking into the experiments of their fellows, and cast about how to draw out of them things of use and practice for man's life, and knowledge[4] as well for works as for plain demonstration of causes, means of natural divinations, and the easy and clear discovery of the virtues and parts of bodies.[5] These we call Dowry-men or Benefactors.[6]

"Then after divers meetings and consults of our

[1] *qui libros, et materias et exemplaria experimentorum ad nos perferunt.*

[2] In the translation they are called *Venatores*, hunters; a name, however, which does not seem to distinguish their peculiar office so accurately as "mystery-men," that is, men whose business was to inquire after mysteries, *i. e.* crafts.

[3] These represent the formation of the tables comparentiæ, absentiæ in proximo, and graduum. See *Novum Organum*, ii. § 11—13. — *R. L. E.* For "compilers," the translation has *divisores*, distributors.

[4] *necnon quæ inserviant scientiis, non solùm quoad opera, sed, &c.*

[5] *quæ sint in corporibus singulis partes latentes, quæ virtutes.*

[6] These represent the Vindemiatio prima. See *Nov. Org.* ii. § 20. — *R. L. E.*

whole number, to consider of the former labours and collections,[1] we have three that take care, out of them, to direct new experiments, of a higher light, more penetrating into nature than the former. These we call Lamps.

"We have three others that do execute the experiments so directed, and report them. These we call Inoculators.

"Lastly, we have three that raise the former discoveries by experiments into greater observations, axioms, and aphorisms.[2] These we call Interpreters of Nature.

"We have also, as you must think, novices and apprentices, that the succession of the former employed men do not fail; besides a great number of servants and attendants, men and women. And this we do also: we have consultations, which of the inventions and experiences which we have discovered shall be published, and which not: and take all an oath of secrecy, for the concealing of those which we think fit to keep secret: though some of those we do reveal sometimes to the state, and some not.[3]

"For our ordinances and rites: we have two very long and fair galleries: in one of these we place patterns and samples of all manner of the more rare and excellent inventions: in the other we place the statua's of all principal inventors. There we have the statua

[1] *qui labores et collectiones priores penitus introspiciunt et quasi ruminantur.*

[2] The translation adds that this was only done after consultation with the whole body. *Quod faciunt non nisi consultatione et colloquis prius habitis cum sociis universis.*

[3] *Etsi nonnulla ex iis, cum consensu, interdum Regi aut Senatui revelemus: alia autem omnino intra notitiam nostram cohibemus.*

of your Columbus, that discovered the West Indies: also the inventor of ships: your monk that was the inventor of ordnance and of gunpowder: the inventor of music: the inventor of letters: the inventor of printing: the inventor of observations of astronomy: the inventor of works in metal: the inventor of glass: the inventor of silk of the worm: the inventor of wine: the inventor of corn and bread: the inventor of sugars: and all these by more certain tradition than you have. Then have we divers inventors of our own, of excellent works; which since you have not seen, it were too long to make descriptions of them; and besides, in the right understanding of those descriptions you might easily err. For upon every invention of value, we erect a statua to the inventor, and give him a liberal and honourable reward. These statua's are some of brass; some of marble and touch-stone; some of cedar and other special woods gilt and adorned: some of iron; some of silver; some of gold.

"We have certain hymns and services, which we say daily, of laud and thanks to God for his marvellous works: and forms of prayers, imploring his aid and blessing for the illumination of our labours, and the turning of them into good and holy uses.

"Lastly, we have circuits or visits of divers principal cities of the kingdom; where, as it cometh to pass, we do publish such new profitable inventions as we think good. And we do also declare natural divinations[1] of diseases, plagues, swarms of hurtful creatures, scarcity, tempests, earthquakes, great inundations, comets, temperature of the year, and divers other things;

[1] *Prædicimus etiam antequam adveniant (id quod ad Naturales Divinationes pertinet) morbos epidemicos, &c.*

and we give counsel thereupon what the people shall do for the prevention and remedy of them."

And when he had said this, he stood up; and I, as I had been taught, kneeled down; and he laid his right hand upon my head, and said; "God bless thee, my son, and God bless this relation which I have made. I give thee leave to publish it for the good of other nations; for we here are in God's bosom, a land unknown." And so he left me; having assigned a value of about two thousand ducats, for a bounty to me and my fellows. For they give great largesses where they come upon all occasions.

[THE REST WAS NOT PERFECTED.]

MAGNALIA NATURÆ,

PRÆCIPUE QUOAD USUS HUMANOS.[1]

The prolongation of life.
The restitution of youth in some degree.
The retardation of age.
The curing of diseases counted incurable.
The mitigation of pain.
More easy and less loathsome purgings.
The increasing of strength and activity.
The increasing of ability to suffer torture or pain.
The altering of complexions, and fatness and leanness.
The altering of statures.
The altering of features.
The increasing and exalting of the intellectual parts.
Versions of bodies into other bodies.
Making of new species.
Transplanting of one species into another.

[1] This paper follows the *New Atlantis* in the original edition, and concludes the volume.

Instruments of destruction, as of war and poison.

Exhilaration of the spirits, and putting them in good disposition.

Force of the imagination, either upon another body, or upon the body itself.

Acceleration of time in maturations.

Acceleration of time in clarifications.

Acceleration of putrefaction.

Acceleration of decoction.

Acceleration of germination.

Making rich composts for the earth.

Impressions of the air, and raising of tempests.

Great alteration; as in induration, emollition, &c.

Turning crude and watry substances into oily and unctuous substances.

Drawing of new foods out of substances not now in use.

Making new threads for apparel; and new stuffs; such as paper, glass, &c.

Natural divinations.

Deceptions of the senses.

Greater pleasures of the senses.

Artificial minerals and cements.

PHILOSOPHICAL WORKS.

PART III.

WORKS ORIGINALLY DESIGNED FOR PARTS OF THE INSTAURATIO MAGNA, BUT SUPERSEDED OR ABANDONED;

ARRANGED

ACCORDING TO THE ORDER IN WHICH THEY WERE WRITTEN.

"Because you were wont to make me believe you took liking to my writings, I send you some of this vacation's fruits; and thus much more of my mind and purpose. I hasten not to publish: perishing I would prevent; and am forced to respect as well my times as the matter. For with me it is thus, and I think with all men in my case: if I bind myself to an argument, it loadeth my mind; but if I rid myself of the present cogitation, it is rather a recreation. This hath put me into these miscellanies, which I purpose to suppress if God give me leave to write a just and perfect volume of Philosophy, which I go on with, though slowly." — *Letter to Bishop Andrews upon sending him the "Cogitata et Visa."*

PREFACE.

We have now collected all of Bacon's philosophical works which there is reason to believe he would himself have cared to preserve. The rest contain but little matter of which the substance may not be found in one part or another of the preceding volumes, reduced to the shape in which he thought it would be most effective. In his eyes, those which follow belonged to the part of the race which was past and was not to be looked back upon; for the end which he was pursuing lay still far before him, and his great anxiety was to bequeath the pursuit to a second generation, which should start fresh from the point where he was obliged to leave it.

It is not so however with us. In our eyes the interest which attaches to his labours is of a different kind. We no longer look for the discovery of any great treasure by following in that direction. His peculiar system of philosophy, — that is to say, the peculiar method of investigation, the "organum," the "formula," the "clavis," the "ars ipsa interpretandi naturam," the "filum Labyrinthi," or by whichever of its many names we choose to call that artificial process by which alone he believed that man could attain a knowledge of the laws and a command over

the powers of nature, — of this philosophy we can make nothing. If we have not tried it, it is because we feel confident that it would not answer. We regard it as a curious piece of machinery, very subtle, elaborate, and ingenious, but not worth constructing, because all the work it could do may be done more easily another way. But though this, the favourite child of Bacon's genius which he would fain have made heir of all he had, died thus in the cradle, his genius itself still lives and works among us; whatever brings us into nearer communion with that is still interesting, and it is as a product and exponent of Bacon's own mind and character that the Baconian philosophy, properly so called, retains its chief value for modern men.

Viewed in this light, the superseded or abandoned pieces which are here gathered together under this third head are among the most interesting of the whole collection. For in them we may trace more than can be traced elsewhere of what may be called the *personal* history of his great philosophical scheme, — the practical enterprise in which it engaged him, and its effect on his inner and outer life. We cannot indeed trace the Idea back to its great dawn: to the days when, in the fearless confidence of four and twenty, he wrote TEMPORIS PARTUS MAXIMUS at the head of the manuscript in which it was first set forth, — thinking no doubt in his inexperience that Truth had only to show her face in order to prevail. Our records do not go so far back as that: and before the period at which they begin a shadow had fallen across the prospect. The presumptuous "maximus" has been silently withdrawn and "masculus" put in its place.

Instead of that overconfidence in the sympathy of his generation we find what looks like an overapprehension of hostility. And it is in deprecating general objections; in answering, mollifying, conciliating, or contriving to pass by prejudices; in devising prefaces, apologies, modes of putting his case and selecting his audience so as to obtain a dispassionate hearing for it; that we find him, if not chiefly, yet much and anxiously employed.

It is probably to the experiences and discouragements of this part of his career that we owe the greater part of the first book of the *Novum Organum*, which embodies all the defensive measures into which they drove him; but though the result may be seen there, the history may be better traced in these fragments. It is in them that we can best see how early this idea of recovering to Man the mastery over Nature presented itself to him; presented itself not as a vague speculation or poetic dream, but as an object to be attempted; the highest at which a man could aim, yet not too high for man to aim at; — how certain he felt that it might be accomplished if men would but make the trial fairly; how clearly he saw or thought he saw the way to set about it; how vast his expectations of the good to come; how unshakable his confidence in the means to be used; what immense intellectual operations that confidence gave him courage to enter upon and patience to proceed with, — deliberately, alone, year after year, and decade after decade, still hoping for success in the end, — delays, distractions, disappointments, discouragements internal and external, notwithstanding. They serve moreover to remind us of another fact which it is not unimportant to remember, and which, judging

from the events of later times, we are too apt to overlook or forget, — namely, how little *authority* in matters of this kind his name carried with it in those days. "A fool could not have written it, and a wise man would not," is said to have been the criticism of a great Oxford scholar upon an early sketch of the *Instauratio*. And how little Bacon could trust for a favourable hearing of his case to his personal reputation among his contemporaries during the first fifty years of his life, appears from his hesitation, uncertainty, and anxiety as to the form in which he should cast it, and the manner in which he should bring it forward. For we find among these fragments not merely successive drafts of the same design, (which would prove nothing more than solicitude to do the work well,) but also experimental variations of the design itself, in which the same matter is dressed up in different disguises, with the object apparently of keeping the author out of sight; as if he had thought that a project of such magnitude would be entertained less favourably if associated with the person of one who had done nothing as yet to prove any peculiar aptitude for scientific investigation, or to entitle him to speak on such matters with authority. Thus at one time he seems to have thought of bringing his work out under a fanciful name, probably with some fanciful story to explain it; as we see in the mysterious title "*Valerius Terminus*, &c. with the Annotations of *Hermes Stella*." At another he presents the same argument in a dramatic form; as in the *Redargutio Philosophiarum*, where great part of what became afterwards the first book of the *Novum Organum* is given as a report of a speech addressed to an assembly of philosophers at Paris. At

another he tries to disguise himself under a style of assumed superiority, quite unlike his natural style; as in the *Temporis Partus Masculus*, where again the very same argument (for it is but another version of the *Redargutio Philosophiarum*) is set forth in a spirit of scornful invective poured out upon all the popular reputations in the annals of philosophy; — a spirit not only alien from all his own tastes and habits moral and intellectual, but directly at variance with the policy which he was actually pursuing in this very matter; which was to avoid as much as possible all contradiction and collision, and to treat popular prejudices of all kinds with the greatest courtesy and tenderness: — an inconsistency which I know not how to account for, except by supposing that he had been trying experiments as to the various ways in which popular opinion may be conciliated; and knowing that many a man had enjoyed great authority in the world by no better title than that of boldly assuming it, had a mind to try how he could act that part himself, and so wrote this exercise to see the effect of it; and finding the effect bad, laid it by. Another thought which he had, — still probably with the same view of avoiding the contrast between the lofty pretensions of the project and the small reputation of the author, — was to publish it in a distant place. In July, 1608, remembering that a prophet is not without honour except in his own country, he was considering the expediency of beginning to print in France.[1] And about the same time the idea of shadowing himself under the darkness of antiquity seems to have occurred to him: for I am much inclined to think that it was some such consid-

[1] Commentarius solutus.

eration which induced him in 1609 to bring out his little book *De Sapientiâ Veterum;* where, fancying that some of the cardinal principles of his own philosophy lay hid in the oldest Greek fables, he took advantage of the circumstance to bring them forward under the sanction of that ancient prescription, — and so made those fables serve partly as pioneers to prepare his way, and partly as auxiliaries to enforce his authority.

Altogether, the result of my endeavours to arrange and understand these experimental essays and discarded beginnings, is a conviction that Bacon was not more profoundly convinced that he was right, than uneasily apprehensive that his contemporaries would never think him so; and that for the first fifty years of his life his chief anxiety was, not so much to bring his work into the most perfect shape according to his own conception, as to bring it before the world in a manner which should insure patient and attentive listeners, and involve least risk of miscarriage, — the carrying of the world with him being in such an enterprise a condition essential to success. And this I have thought the more worth pointing out, because the course of proceeding which he ultimately resolved on tends to hide it from us. For his final resolution was, as we know, to discard all fictions and disguises, and utter his own thoughts in his own person after the manner which was most natural to him. But we are to remember that before he came to that determination, or at least before he put it in execution, the case was materially altered and the principal cause of embarrassment removed. For besides that he had then been four years Lord Chancellor, the great reputation which he had

acquired in other fields — in the House of Commons, the Courts of Law, and the Star-Chamber, — coupled with the well-known fact that his favourite pursuit all the time had been natural philosophy, concerning which he had long had a great work in preparation, — this reputation had given to his name the weight which before it wanted; insomuch that there was then perhaps no mouth in Europe which could command a larger audience, or from which the prophecy of a new intellectual era coming upon the earth could proceed with greater authority, than that of Francis Bacon.

Nevertheless, when I say that these pieces are chiefly interesting on account of the light they throw on Bacon's personal hopes, fears, and struggles, I am far from meaning to underrate their intrinsic and independent value. Those who are most perfectly acquainted with the works by which they were superseded will not the less find them well worth the studying. Many of them are in form and composition among Bacon's most perfect productions; and if in successive processes of digestion he succeeded in sinking the thought deeper and packing the words closer, it was often at the expense of many natural and original graces. What they have gained in weight and solidity they have lost sometimes in freshness, freedom, and perspicuity; and it will generally be found that each helps to throw light on the other.

J. S.

COGITATIONES

DE

SCIENTIA HUMANA.

PREFACE

TO THE

COGITATIONES DE SCIENTIA HUMANA.

THE value of this collection would be much increased if the dates of the several pieces could be fixed, or even the order of succession. I fear however that it is impossible to do this with any certainty. I have arranged them in the order in which it seems to me most probable that they were written, but the evidence is so scanty and unsatisfactory that I wish every reader to consider it an open question and to judge for himself upon the data which will be laid before him.

This which I place first, and to which for convenience of reference I give the title *Cogitationes de Scientiâ Humanâ*, is a fragment, or rather three separate fragments, that have not been printed before. They are copied from a manuscript which came to the British Museum among the papers of Dr. Birch, who appears to have received it from the executors of Mr. John Locker. Locker was a friend of Robert Stephens, the Historiographer Royal; was employed by him to see through the press his second collection of Bacon's letters, published in 1734; was afterwards engaged in preparing an edition of all Bacon's works, but died before it was completed; whereupon the task, together with

the papers which he had collected, was transferred to Dr. Birch.

Of the history of this manuscript I have not been able to learn anything beyond what appears upon the face of it. It is a transcript in a hand of the 18th century, and has evidently been made from a mutilated original; blank spaces having been left by the transcriber in several parts, such as would occur in the copy, not of an unfinished or illegible writing, but of one worn away at the edges of the outer leaves. The leaves of the transcript are put together in a false order, and are not numbered; which makes it less easy to guess what the original consisted of. But it looks as if there had been three separate papers, each wanting a leaf or two at the beginning, and each containing a series of "Cogitationes" or short philosophical essays. The transcript has been corrected throughout by Locker himself and prepared for the press or the copyist; some passages being marked for omission, and some to stand, and titles being added to the latter. It seems that he meant to include in his edition of Bacon's works all those portions which were not to be found elsewhere in the same or nearly the same words. As these titles do not appear to have formed part of the original, I have omitted them here; my object being to print Bacon's own paper as Locker received it; which I suppose the transcriber to have copied as correctly as he could.

The subjects of cogitation are various, and not arranged in any logical order. I find interspersed among them the four fables, *Metis*, *Soror Gigantum*, *Cœlum*, and *Proteus*, exactly as they are printed in the *De Sapientiâ Veterum;* and the fifth, sixth, seventh, and

tenth of the *Cogitationes de Rerum Naturâ*, exactly as they are given by Gruter; except a few verbal differences which I have pointed out where they occur. In the last mentioned (which forms the seventh article of the first fragment), the passage about the new star in Cassiopeia appears in the same words and with the same context precisely; and therefore the reasons which I have given for presuming that the *Cogitationes de Rerum Naturâ* were written before 1605 are equally applicable to this fragment. It is on this account that I place it first in the series; not that some of the other pieces contained in this part may not have been written earlier than 1605, but that there is none among them concerning which I have such good grounds for concluding that it cannot have been written later.

The Cogitatio in which this passage occurs is immediately followed by one on the true relation between natural philosophy and natural history; in which the kind of natural history on which a sound and active philosophy may be built is particularly described. If we could be sure that this also was written before 1605, the fact would be valuable; as showing that this part of the design was no after thought, but was as clearly conceived, and its essential importance as fully recognised, in 1605 as in 1620. In the *Parasceve* and in the admonition prefixed to the *Historia Ventorum* (*monendi sunt homines*, &c.), the impossibility of carrying the work on without such a collection of natural history, though more fully and anxiously insisted upon, is not more distinctly understood. The presumption however which fixes the date of the preceding Cogitatio does not necessarily hold with regard to this,

because it *may* no doubt have been added afterwards; and the word *partitionem* at the end of the paragraph in page 448 may seem to imply that it was meant for the *Partitiones Scientiarum*, and therefore written after the plan of the *Instauratio Magna* had been laid out in its ultimate form.

The miscellaneous character of these meditations makes the loss of the rest of less consequence. It is easy to strike into the argument of each, and to refer it to its proper place in Bacon's philosophy. It may be convenient however, as they are for the most part without explanatory titles, to give here a list of the several pieces, with a note of the subjects to which they refer.

FIRST FRAGMENT.

1. (Cog. 3.) *Of the limits and end of Knowledge:* the same argument which is handled in the first chapter of *Valerius Terminus*, and the opening of the *Advancement* of *Learning*. (The beginning wanting.)
2. (Cog. 4.) *Of the Use of Knowledge.*
3. (Cog. 5.) *The fable of Metis.*
4. (Cog. 6.) *The fable of the Sister of the Giants.*
5. (Cog. 7.) *The fable of Cœlum.*
6. (Cog. 8.) *The fable of Proteus.*
7. (Cog. 9.) *Of the error in supposing a difference in point of eternity and mutability between things celestial and things sublunary.*
8. (Cog. 10.) *Of Natural History considered as the groundwork of Natural Philosophy.* (Imperfect at the end.)

SECOND FRAGMENT.

1. (Cog. 8.) *That general consent affords no presumption of truth in matters intellectual.*
2. (Cog. 9.) *Of the error of supposing that conversancy with particulars is below the dignity of the human mind.*
3. (Cog. 10.) *The exposition of the fable of Midas.* (Not included in the *De Sapientiâ Veterum.*)

THIRD FRAGMENT.

1. *Of wisdom in the business of life.* (The beginning wanting.)
2. *That the quantum of matter is always the same.*
3. *Of the sympathy between bodies with sense and bodies without.*
4. *Of apparent rest, and solidity and fluidity.*

The notes to these pieces, and the explanatory remarks within brackets, are mine.

J. S.

COGITATIONES DE SCIENTIA HUMANA.

THE FIRST FRAGMENT.[1]

. . . . a Deo defectionem homini insinuavit.[2] Quod vero ad terminos sobrietatis attinet, eos demum legitimos et veros esse censemus, qui sensus aditum ad divina prohibeant; ut jam dictum est. Si enim per alas sensus male conglutinatas ad Dei naturam, vias, voluntatem, regimen, et reliqua mysteria, tanquam ex propinquo audacius conspicienda, superbo volatu efferamur, præcipitium certum nos manet. Atque hoc est quod per *fallaciam philosophiæ et gloriæ oppressionem* cavere jubemur. Quicquid vero non est Deus, sed pars Universi aut Creatura, hujus certe contemplatio et scientia obscuritate sæpius et difficultate removetur, sed nullo edicto separatur. Certe Scriptura, post vicissitudines rerum et temporum commemoratas, ad extremum subjungit: *Cuncta fecit bona in tempore suo, et mundum tradidit disputationibus eorum; ut tamen non inveniat homo quod operatus est Deus ab initio usque ad finem:* ubi satis aperte significat, tradi certe mundum hominum contemplationibus et controversiis, et infinitas

[1] Additional MSS. Brit. Mus. 4258. fo. 219.

[2] He has been speaking, probably, of the nature of the temptation which led to the fall of man; viz. the promise that he should be as God, *knowing good and evil.*

et abditas Naturæ operationes posse erui; opus autem quod operatus est Deus ab initio usque ad finem, id est legem Naturæ summariam, quæ instar puncti verticalis Pyramidis est, in quo omnia coeunt in unum; hoc inquam, non aliud quicquam, ab Intellectu humano seponi. Nam ut idem Author affirmat, *Lucerna Dei est spiraculum hominis quo quæque interiora pervestigat;* et rursus ait, *Gloriam Dei esse rem celare, gloriam Regis autem rem investigare;* non aliter ac si Divina Natura innocenti ac benevolo puerorum ludo delectaretur, qui ideo se abscondunt ut inveniantur, ac animam humanam sibi collusorem in hoc ludo pro sua in homines indulgentia et bonitate elegerit. Itaque Deum Fidei, mundum sensus et scientiæ humanæ, vera objecta esse ponimus. Quod vero ad artificium illud attinet, ut ex ignoratione causarum major sit manus divinæ recognitio et veneratio; hoc nil aliud est quam Deo per mendacium gratificari velle, quo ille prorsus nostro non eget. Etiam et illæ cogitationes parum piæ sunt, si quis Dei vicem timeat, ne religio detrimentum accipiat. Nam hæc rationem animalem et fidei inopiam sapiunt, et religionem tacite quodammodo imposturæ insimulant [ac] si periculum ei ab inquisitione veritatis subsit. Neque metuat quisquam ut Sensui Fides magis ex diametro opponi possit quam per ea quæ nunc, virtute afflatus divini, creduntur; mundi creationem ex nihilo; Dei incarnationem; carnis resurrectionem. Atque nobis certe perfectissimum est, Naturalem Philosophiam, post verbum Dei, certissimam superstitionis medicinam, eandem (quod mirum videri possit) probatissimum fidei alimentum esse; quantoque altius penetret, tanto fortius animos hominum religione perfundere. Nam in limine philosophiæ, in causis proximis moram faciendo,

fortasse animus nonnihil deprimitur, et sensui obnoxius efficitur. Sed postquam ascensus factus est, et catena causarum ex opere divino fabrefacta in conspectum venit, erigitur proculdubio animus, et ad religionem præparatur. Itaque existimamus Scientiam de Natura tanquam fidissimam Religioni ancillam præsto esse, cum altera voluntatem Dei, altera potestatem manifestet. Neque erravit qui dixit *Erratis nescientes scripturas et potestatem Dei;* informationem de Voluntate, tanquam Fidei instrumentum, et meditationem de Potestate, tanquam ejusdem adminiculum, conjungens. Veruntamen (quod verum rebus humanis præsidium est) ad preces confugimus, et Deum supplices rogamus ne ex reseratione viarum sensus et accensione majore luminis naturalis aliquid incredulitatis aut noctis animis nostris erga divina mysteria oboriatur; sed potius ut ab intellectu a phantasiis et vanitate puro et repurgato, et divinis oraculis nihilominus subdito ac prorsus dedititio, *Fidei dentur quæ Fidei sunt.*

Cogitatio 4ta.

Atque cum de terminis et finibus Philosophiæ jam dictum sit, res postulare videtur ut de usu ejus aliquid addamus. Omnis enim scientia usu prudenter terminatur; atque usui nomen finis vel præcipue competit: in quo altius rem repetere visum est, ut fortius quod tantum hominum intersit mentibus eorum incutiamus. In Divina Natura radius trinus per omnia splendet, et in operibus et in attributis. Essentia et Creatio Materiæ ad Patrem; Essentia et Creatio Formæ ad Filium; duratio et conservatio Essentiæ ad Spiritum Santum refertur. Neque enim ait Scriptura *Dixit Deus, fiat Cœlum et Terra,* sed *Creavit Deus Cœlum et Terram.*

De operibus autem sex dierum, non ait Scriptura *Creavit Deus Lucem* et quæ sequuntur; sed *Dixit Deus, fiat Lux, et facta est Lux;* et per omnia Creationem præcedit Verbum. Similiter, Potentia Patri, Sapientia Filio, Charitas Spiritui Sancto attribuitur; ut et peccata iisdem attributis respondeant; cum peccata ex infirmitate contra Patrem; peccata ex ignorantia contra Filium; peccata ex malitia contra Spiritum Sanctum esse dicantur. Etiam origines defectionis eodem spectant. Nam ex appetitu potentiæ angeli lapsi sunt; ex appetitu scientiæ homines; sed Charitatis non est excessus; neque inducit charitas tentationem, neque Spiritus aut homo per eam unquam in periculum venit. Qui enim ex plenitudine charitatis sibi exitium et anathema imprecati sunt, ut Paulus et Moses, utcunque in extasi spiritus eo progressi, tamen offensionem apud Deum incurrisse non reperiuntur. Itaque Deus proponitur hominibus ad imitationem, secundum Charitatem, non secundum Potentiam aut Sapientiam. Scriptum enim est, *Diligite inimicos vestros ut sitis filii Patris vestri qui in Cœlis est; qui solem suum oriri facit super bonos et malos, et pluit super justos et injustos.* Angelus autem dixit in se, *Ascendam et ero similis Altissimo:* non dixit *Deo*, sed *Altissimo.* Similiter Homo, postquam tentationem hausisset, efferebatur, et concupivit ut similis esset Deo; non simpliciter, sed in hoc ut sciret Bonum et Malum. Neuter ad similitudinem charitatis divinæ se excitabat; sed Angelo ministerii Dominatio, Creaturæ dominanti Scientia, desiderio fuit. Atque hæc in præsenti adducimus, ut homines tantis oraculis moniti scientiæ veros fines cogitent; nec eam aut animi causa petant, aut ut alios despiciant, aut ad commodum, aut

ad lucrum, aut ad gloriam, aut hujusmodi inferiora. Atque hic rursus, ut prius, Deum precamur ut deposito scientiæ veneno, a serpentis veneno jam a principio infuso, quo animus humanus tumet, nec altum sapiamus, nec ultra sobrium, sed Veritatem in Charitate colamus.

COGITATIO 5ta.

Narrant poetæ antiquj Jovem cepisse in uxorem Metin, &c.

[Here follows the exposition of the fable *Metis sive Consilium*, for which see *De Sapientiâ Veterum*, § xxx.]

COGITATIO 6ta.

Finxere poetæ Gigantes e terrâ procreatos, &c.

[Here follows the exposition of the fable *Soror Gigantum sive Fama;* for which see *De Sap. Vet.* § x.]

COGITATIO 7ma.

Finxere poetæ Cœlum antiquissimum, &c.

[Here follows the exposition of the fable *Cœlum sive origines;* for which see *De Sap. Vet.* § xii.]

COGITATIO 8a.

Narrant poetæ Proteum, &c.

[Here follows the exposition of the fable *Proteus sive Materia;* for which see *De Sap. Vet.* § xiii.]

COGITATIO 9a.

De dissimilitudine cœlestium et sublunarium quoad æternitatem et mutabilitatem, quod non sit verificata.

[See *Cogitationes de Rerum Naturâ*, § x., p. 228. of this volume. These five Cogitationes agree exactly with the copies elsewhere given, with the exception of a very few verbal variations, which I have mentioned in the notes. With regard to the last it is to be observed that, though it follows the 8th Cogitatio without any break, the words *Cogitatio* 9ª. are not written at the head of it, as in all the preceding; but *Cog.* 10. is inserted in the margin; from which I infer that it was not numbered in the original, and that the number 10 was inserted afterwards by the transcriber in reference to the *Cogitationes de Rerum Naturâ* where it stands tenth and last. That it formed part of the present series however, and belonged to this place, may be inferred from the fact that it is immediately followed by]

Cogitatio 10ª.

Fundamenta solida Philosophiæ Naturalis purioris, in Naturali Historia jaciuntur; eaque copiosa et accurata. Aliunde petita philosophia natat et ventosa est et agitatur et se confundit; nec ad utilitates humanas et partem activam ducit[1] aut pertingit. Atque ut distinctius loquamur, Historia Naturalis aut non satis investigata aut non satis inspecta duo vitia et veluti morbos aut corruptiones Theoriarum peperit. In altero homines ad Sophistæ potius, in altero ad Poetæ partes accedunt. Qui enim ex vulgaribus observationibus theoriæ principiis concinnatis, reliqua in ingenii discursu et argumentatione ponit, is quamcunque existimationem aut fortunam Inventa sua sortiantur, tamen revera ex veterum Sophistarum more et disciplina phi-

[1] *durat* in MS.

losophatur. Qui autem ex portione Naturæ diligenter et exquisite indagata et observata tumidus et phantasiæ plenus alia omnia ad ejus exemplum et similitudinem fieri fingit et somniat, is inter Poetas sane est conscribendus. Itaque prudens et acutum erat illud Heracliti dictum cum quereretur homines Philosophiam in mundis propriis non in mundo majore quærere. Naturalem enim Historiam leviter attingunt, atque in meditationibus suis in immensum expatiantur; neque hæc prudenter dividunt. Atque hujus rei exemplum, præsertim morbi illius prioris, in Philosophis Scholasticis se prodit; qui cum ingenii acumine et robore pollerent, et otio abundarent; historiæ autem aut naturæ aut temporum parvam partem nossent; nec omnino variam doctrinam hausissent; sed meditationes suas intra veluti cellas paucorum authorum, præcipue Aristotelis (qui dictaturam apud eos gerebat), quemadmodum personas intra cellas monasteriorum et collegiorum clausissent; ferocitatem autem et confidentiam eam quæ illos qui pauca norunt sequi solet (ut animalia in tenebris educata) acquisivissent; ex materiæ quantitate non magna, ingenii vero agitatione infinita, telas eas doctrinæ confecerunt, quæ (ut illæ etiam aranearum) tenuitate fili et texturæ subtilitate sunt admirabiles, sed substantia et virtute fere inutiles. Longe autem magis mirandum est Aristotelem, tantum virum, et tanti Regis opibus innixum, et in tanta rerum et historiæ varietate versatum, quique ipse tam accuratam de Animalibus historiam conscripserit, atque insuper experimentis cujusvis generis cogitationem impertierit, (quod ex libris ejus Problematum et Parvis Naturalibus manifestum est), quique etiam[1] sensui justas partes

[1] *enim* in MS.

tribuerit; tamen Philosophiam suam de Natura a Rebus omnino abstraxisse,[1] et experientiæ desertorem maximum fuisse, atque ea tantis laboribus peperisse quæ Dialecticæ potius (utcunque homines distinguant et argutentur[2]) quam Physicæ aut Metaphysicæ sint accommodata. Verum ille ingenio incitato et imperioso, atque per omnia ipse sibi author (cum antiquitatem despiceret, experientiam autem in servilem modum ad opinionum suarum fidem traheret et quasi captivam circumduceret), meritoque sane galeam Plutonis (obscuritatem scilicet quandam artificiosam) induens, cum tantas turbas concivisset; denique Dialecticam suam, utpote artem ab eo (ut ipse licentius nec tamen vere gloriatur) oriundam, interponens, et res verbis mancipans, varietatem doctrinæ et scientiæ suæ usu ambitioso et callido corrupit. Nos vero, licet propter facultatis nostræ tenuitatem statuam Philosophiæ efformare aut erigere non possimus, saltem basin ei paremus, atque Historiæ Naturalis usum et dignitatem hominibus præcipue commendemus. Neque enim inventio prima Philosophiæ tantum ab ea pendet, sed etiam omnis inventorum amplificatio et correctio. Ut enim aquæ non altius ascendunt quam ex quo descenderunt, ita doctrina et informatio ab aliquo authore veluti cisterna quadam derivata non facile supra ejusdem authoris inventa scandit aut insurgit. Ipsi rerum fontes petendi sunt. Quamobrem si qua nobis fides est aut judicium in his rebus, quas certe summa cum cura et maximis et indefessis animi laboribus tractamus, id ante omnia consulimus et monemus, ut Historia Naturalis diligens et seria et fida procuretur et comparetur. Atque habemus sane Historiam Naturalem,

[1] *abstraxisset* in MS. [2] *arguentur* in MS.

mole amplam, genere variam, diligentia etiam curiosam; veruntamen si quis ex ea ipsa fabulas et antiquitatis mentionem et philologiam et opiniones et similia excerpat ac seponat, quæ convivalibus potius sermonibus et virorum doctorum noctibus quam institutioni Philosophiæ sunt accommodata, ad nil magni res recidet. Neque novum est invenire diligentiam simul in rebus supervacuis curiosam et in magis necessariis imparem. Atque hoc minime mirum videri debet, Naturalem Historiam quæ in manibus habetur[1] non eam esse quam nos animo et cogitatione metimur et concipimus, cum hoc plerunque fiat, ut quod fine id fere natura et genere differat. Naturalis autem Historiæ inquisitio ab aliquibus suscepta est ut jucunda et grata peregrinatio, quæ et cognitione et commemoratione delectet. Aliis doctrinæ variæ et lectionis multiplicis fama est quæsita. Nobis autem longe aliud propositum est. Eam enim Naturalem Historiam quærimus ex qua causæ naturales potissimum informari possint, et Philosophia condi, sensui fida, et operibus testata. Itaque magna cura et judicii severitas adhibenda est ut hujusmodi Historia[2] sit fide certa, observatione definita non vaga, complexu rerum lata et copiosa. Atque ut clarius et melius intelligatur quid tandem desideremus[3] et velimus, non alia magis ratione illud declarari posse judicamus quam si Partitionem Naturalis Historiæ subjungamus fini ipsi nostro consentaneam.

Historia [Naturalis,[4]] vel Naturæ liberæ et tamen ordinatæ, [vel Na]turæ errantis sive expatiantis, vel

[1] *habemus* in MS. [2] *historiæ* in MS. [3] *desyderemus* in MS.

[4] The spaces between the brackets are left blank in the manuscript. The words which I have inserted are supplied by conjecture.

Naturæ [arte] subactæ et constrictæ, facinora narrat. Alia enim est Naturæ dispensatio et actio cum sponte fluit; alia cum materiæ defectibus et excessibus et pravitatibus et insolentiis urgetur; alia denique cum arte et ministerio humano premitur. Itaque prima narratio est ea cui Naturalis Historiæ Communis appellatio tribuitur; cujusmodi est Aristotelis, Plinii, Dioscoridis, Gesneri, Agricolæ, reliquorum. Secunda, Historia Mirabilium nuncupatur, aut simili titulo gaudet; quam etiam Aristoteles ipse non contempsit, alii autem ita tractarunt ut eorum vanitatis et levitatis nota in rem ipsam incurrat. Tertia est Historia Mechanica sive Artium; cui nemo incubuit aut operam constantem et justam impendit; sed alii alias artes, neque tamen multi multas, scripto aliquo fortasse [tractarunt] eoque ipso obscuro et ignobili, et [quod] apud plerosque lectores sordescit. Atque earum partium prima rursus in quatuor partes recte dividitur; Historiam Cœlestium; Historiam Meteororum; Historiam Terræ et Maris; et Historiam Specierum. Historiam Cœlestium simplicem esse cupimus; suspensa omnino vi et potestate Theoriarum; quæque solummodo phænomena ipsa sincera, nempe astrorum numerum, magnitudinem, situs, facies, motus, complectatur; non omissa rerum vulgatissimarum mentione, eaque exacta; addita etiam observatione colorum, scintillationum, positionum, et similium, licet ad cursus astrorum descriptionem nil faciant. Non enim calculos meditamur, sed Philosophiam; eam quæ scilicet de superiorum non motu tantum, sed substantia quoque et potestate, intellectum humanum informare possit. Historia vero Meteororum (ut et ipsa) ex imperfecte mistis est. Postquam Aristoteles [1]

[1] *Aristotelis* in MS.

principia rei dedisset (licet diverso ab Historia modo) nulla quæ mentione digna est continuatio sequuta est, quæ tamen huic parti vel maxime a . . .[1] res sit ex naturalibus maxime instabi[lis et] quæ regionibus et temporibus plurimum [vari]etur. Si quid autem in Historia Civili et annalibus temporum, de meteoris, aliquibus cometis, terræ motibus, tempestatibus, et hujusmodi, sparsim inseritur, illud sæpius ejusmodi est ut potius calamitatis et ominis rei quam naturæ et modi meminerit. Certe inter Meteororum Historiam dignissima commemoratio fuisset de Cometis, utilissima de Ventis. Nec ea spernenda esset quæ est de pluviis prodigiosis vel de rebus quæ ex alto decidunt, si fides constaret. At Historia Terræ et Maris ad pauca extenditur, licet ea quæ ad sphæram et partium terræ cum partibus cœli configurationem pertinent recipiantur. Neque enim termini Imperiorum, urbes, et similia, quæ Cosmographiam implent, Naturalis Historiæ sunt; cum vicissitudines manifestas patiantur et hominem plane spirent. Terræ figura, maris interpositio et occupatio, minerarum moles, solum ipsum non feracitate [sed] substantia distinctum, fluvii, la[cus, si]nus, litora, paludes, æstus maris, gurgites et Euripi, aquæ calidæ et varie . . . infectas[2] igne exundantes, et reliqua id genus, hujusmodi narrationi debentur: res sane vulgatæ, sed consequentiæ earum non vulgatæ. Nam maria inter Tropicos, et magna utrimque a Tropicis distantia, pervia non esse; duas insulas veteris et novi orbis versus Boream latas, versus Au[strum angustas] efformari; Africam et inferiorem Americam peninsulas esse; Mediterraneum mare sinuum, Cas-

[1] *debetur, cum?* The top of the *d* being worn off, it would look like *a*.
[2] So in MS. The blank may be filled with *per rimas*.

pium [l]acuum, maximum conspici; et similia; si per se accipias occurrunt, sed tamen Philosophia consuluntur et ad multa informationem præbent. Restat Historia Specierum, quæ certe tam diligenter et copiose elaborata et exculta cernitur, ut non tam aucta ea quam repurgata opus est. Namque[1] multus Plinius in fabulis, antiquitate, et censura morum; Gesnerus autem hæreditatem historiæ suæ ex multis partibus Philologiæ ex paucis Philosophiæ . . . Certe si qua ex parte deficit Historia Naturalis Specierum, ea ipsa est quæ [Hominem] intuetur et refert. Demptis enim c[ivilibus,] parca est Hominis historia naturalis quæ sincera est. Reliqua duo Historiæ Naturalis genera hominibus summæ curæ esse debent. Habet enim historia naturæ sponte sua fusæ contemplationem amœnam, sed inquisitionem vagam. Historia autem Mirabilium homines ad operum magnitudinem invitat; Historia Artium etiam deducit. Itaque quod ad prim[um horum] attinet, facessant fabulæ, imposturæ, levia. Heteroclita sive Devia naturæ examinentur tanquam falsa, referantur et describantur tanquam vera; id est, non aucta re miraculi causa, sed potius intra modum. Ante omnia, fabulæ et mendacia non tantum rejiciantur, sed etiam notentur. Neque enim magis utilem Historiæ Naturalis de Mirabilibus partem esse censeo, quam si ea quæ [apud vulgus opi]nionem quandam veritatis obtinent, [sed facto] experimento falsitatis convincuntur, nominatim damnentur et pro[scribantur.]

[Here the blanks left by the transcriber become so frequent that it is impossible to follow the sense further. Only it may be gathered that, after remarking that

[1] *Nam qua* in MS.

"as things now are, if an untruth in nature be once on foot, what by reason of the neglect of examination and countenance of antiquity, and what by reason of the use of the opinion in similitudes and ornaments of speech, it is never called down," — (I quote a passage from the *Advancement of Learning* with which it is evident that the next sentence in this manuscript closely corresponded,) — Bacon has recourse to the illustration so happily developed in the 118th aphorism of the first book of the *Novum Organum*, comparing the mistakes which will occur in such a natural history as he meditates to the misprints in a book; — if there be but a few, you can correct them by the sense of the passage; if many, you cannot find what the sense is: so it is, he says, with Natural History and Philosophy. "Nam si paucæ vanitates admisceantur, eæ a causis ipsis inventis reprobantur; sin spissæ, ipsam causarum inquisitionem subvertunt. Itaque optimo consilio res geretur, si triplex fidei ordo statuatur. Unus eorum quæ damnantur; alter eorum quæ certo comperiuntur; tertius eorum quæ fidei sunt [dubiæ.]" He concludes his remarks on the Historia Mirabilium by observing that it is useful in two ways — both excellent: "the one" (again I quote the *Advancement of Learning*, for the fragments of the sentence clearly show that it was to the same effect,) — "the one to correct the partiality of axioms and opinions, which are commonly framed only upon common and familiar examples; the other because from the wonders of nature is the nearest intelligence and passage towards the wonders of art; for it is no more but by following and as it were hounding nature in her wanderings, to be able to lead her afterwards to the same place again."

He then proceeds to speak of the Historia Mechanica, — the third and last. And here, the blanks being fewer, the sense may be clearly traced, and the missing words probably supplied.]

Sequitur et superest [Historia] Naturalis Mechanica, sive Exper[ientiæ] qualem artes exhibent: ut agric[ultura], Pictoria,[1] Tinctoria, Fabrilis. Addo [etiam practicas] omnes, licet in artem non coaluerint, ut [ve]nationum, aucupiorum, piscationum. N[eque tamen] excludo mechanicam partem liberalium artium, quas vocant; Musicæ, Perspectivæ, Medicinæ. Hæc autem historia licet res minus solemnis sit et honoris et

. . . . . .

[And here the manuscript suddenly stops in the middle of the page; being evidently a transcript from an original of which the outside leaves had been torn away, and the others more or less injured, — most towards the end.]

[1] *pinctura* in MS.

COGITATIONES DE SCIENTIA HUMANA.

THE SECOND FRAGMENT.

De Scientiis et mente. De præjudicio consensus, quod infirmum sit.[1]

Consensus in doctrinis receptis, cujus ea est potestas ut vim quandam hominum judiciis faciat et contradictionem omnem infamet, recte perpendenti et sanam mentem adducenti tantum a vera et solida authoritate abest ut præsumptionem violentam inducat in contrarium. Scientiarum enim status certe perpetuo est democraticus, qui status tempestas et insania in civilibus appellari consuevit. Neque multo melius se gerit aut probat in intellectualibus. Apud populum enim doctrinæ contentiosæ et pugnaces, aut rursus probabiles et speciosæ, plurimum vigent; quales videlicet assensum aut illaqueant aut alliciunt. Itaque pessimus augur veritatis, studium et admiratio populi. Si quis autem hæc ita fieri concedat, et sit firmior, et turbam professoriam non admodum vereatur, sed cum inter eos non paucos ingenio et judicio excellere videat, ho-

[1] Additional MSS. 4258. fo. 214. This begins at the top of a page, and is not numbered. But as the other two Cogitations which complete this fragment are number 9 and 10, I conclude that this was in fact *Cogitatio* 8*a*, the first seven having been lost.

rum suffragiis moveatur: sciat se ratione fallaci niti. Dubium enim non est, quin per singulas ætates maxima ingenia vim passa sint, dum viri captu et intellectu non vulgares, nihilo secius existimationi suæ caventes, temporis et multitudinis judicio se submiserunt. Non enim apud eosdem est pretium scientiarum et possessio: sed quæ viri præstantes proponunt vulgus æstimat. Quod si cui adhuc tamen mirum videatur quod tot sæculis nil melius his quibus utimur inveniri potuerit, is non meminit hoc sæpius accidere temporibus retroactis potuisse, ut potiora istis caput extulerint et in lucem venerint; verum cum penes populum (ut dictum est) sit judicium et delectus, memoriam eorum interire necesse est; adeo ut altiores contemplationes oriantur aliquando, sed fere non ita multo post opinionum vulgarium ventis agitentur[1] et extinguantur. Quare non dissimulanter monendum et prædicendum est (ne quis fortasse de expectatione sua decidat) veras de natura opiniones a vulgaribus in immensum removeri, et fere religionis instar duras et interdum primo aspectu prodigiosas ad hominum sensus et captus accedere; ut in Democriti opinione de Atomis usu venit, quæ quia paulo interioris notæ erat, lusu excipiebatur. Verum hæc ad animos hominum sanandos qui consensu perstringuntur pertinent.

Cogitatio 9ª.

Insita est in animis hominum a natura et a disciplina opinio et æstimatio tumida et damnosa, quæ philosophiam veram et activam veluti exilio mulctavit, et omni aditu prohibuit. Ea est, minui majestatem mentis humanæ si in experimentis et rebus particularibus, sen-

[1] *ayitantur* in MS.

sui objectis et in materia terminatis, diu et multum versetur; præsertim cum hujusmodi res ad inquirendum laboriosæ, ad meditandum ignobiles, ad dicendum asperæ, ad practicam illiberales, numero infinitæ, et subtilitate pusillæ, videri soleant;[1] adeo ut scientiarum gloriam et nomen polluere fere existimentur. Quin eo usque vanitas ista, et mentis, si verum nomen quæratur, alienatio et excessus, provecta est, ut veritas veluti animæ humanæ indigena, sensus autem intellectum excitare non informare, ab aliquibus assereretur. Neque errorem istum ab iis corrigi contigit qui sensui debitas, id est primas, partes tribuerunt; verum ex his quoque plurimi exemplo et facto suo, relicta omnino historia naturali et mundana perambulatione, omnia in meditatione et ingenii agitatione posuerunt; et sub specioso speculationum et rationalium titulo hominum mentes ad rerum evidentiam nunquam satis applicatas et addictas, inter opacissima et inanissima mentis Idola perpetuo volutare docuerunt.[2] Verum istud rerum particularium repudium et divortium omnia in familia humana turbavit. Neque tantum homines monendi sunt ut experientiæ se restituant atque intellectus commentis et meditationum simulacris non amplius confidant, verum ut inter experimenta ipsa, sive instantias, nec res exiles tanquam leves, nec res vulgatas tanquam superfluas, nec res mechanicas tanquam viles, nec res turpes tanquam indignas, nec res præter naturam tanquam odiosas aut infaustas, despiciant aut rejiciant. Sane si capitolium aliquod humanæ superbiæ condendum et dedicandum esset, non nisi auri fortasse et argenti et eboris ramenta et hujusmodi res preciosas ad fundamenta ejus ingerere per pontifi-

[1] *solent* in MS. [2] *docuerant* in MS.

ces liceret. Sed cum templum sanctum ad instar mundi, mundoque ipsi quantum fieri potest parallelum et concentricum, fundandum sit, merito exemplar per omnia sequi oportet. Nam quod essentia dignum est id etiam dignum est repræsentatione. Scientia autem vera nil aliud est quam essentiæ repræsentatio sive imago. Atque certe quemadmodum e certis putridis materiis optimi odores se diffundunt, ita et ab instantiis sordidis (quibus ut ait Plinius etiam honos præfandus sit) quandoque eximia lux et informatio exhibetur. Eodem modo et res tenues locupletes sæpe testes sunt. Bulla in aquis est res exilis et quasi ludicra ; tamen haud aliam instantiam reperias quæ duarum rerum paulo obscuriorum commodius fidem faciat. Una est de appetitu continuitatis etiam in Liquidis; altera quod aër non magnopere feratur sursum. Etiam nobile illud inventum de acu nautica, quæ stellis ipsis est stella certior, in acubus ferreis, non in virgis aut vectibus ferreis, se conspiciendum dedit. Itaque postulanda est ab hominibus res difficilis sane, et a natura humana prorsus aliena, sed imprimis utilis. Hæc est ut eandem diligentiam, attentionem, perspicaciam, in rebus vulgaribus, parvis, et obviis contemplandis et examinandis sibi imperent, quam in rebus novis et magnis et miris curiositas humana adhibere solet: ratio enim non aliter constat. Neque enim hoc est scire aut causam reddere, si rara ad vulgata referantur et accommodentur ; sed ut eorum quæ raro et eorum quæ frequenter accidunt, causæ constantes et communes inveniantur.

Cogitatio 10ª.

Fabula de servo Midæ ad libellos famosos pertinere videtur. Narrant enim Midæ cubicularium cum anim-

advertisset dominum suum aures habere asininas, id nulli mortalium dicere ausum fuisse; sed cum futilitatem naturalem reprimere non potuisset, cum ore in terræ rimam applicato quod viderat retulisse; unde arundines editas esse, quæ levi aura motæ illud murmure et susurro enuntiarent. Sensus est: cum regum et procerum defectus et vitia ministris interioribus innotuerint, eos vanitate aulica et palatina secreti impatientes esse, nec debito silentio ea cohibere. Ac si forte verbis abstineant, tamen aliis indiciis ea prodere, quæ postea in calamos ingeniorum malignorum incidant; qui maxime sub inclinatione temporis ad turbas et rerum tumorem (tanquam vento flante) invidiosis et famosis libellis ea spargunt in vulgus.

[Here the manuscript stops before the bottom of the page; and the other page is left blank.]

COGITATIONES DE SCIENTIA HUMANA.

THE THIRD FRAGMENT.

. . .[1] hominum actiones æquæ et indifferentes, et propterea vel optime [mo]rato liberæ sunt. Rebus autem agendis et usui singula, et interdum quæ minima videntur, aut prosunt aut officiunt. Adeo ut verba, vultus, oculi, gestus, joci, sermo quotidianus, ad rem faciant, et nil fere imperio et decreto vacet. Etiam virtutis formæ magis simplices et inter se consentientes sunt. Prudentia autem Civilis innumeras formas, easque maxime inter se contrarias, quæ rebus, personis, temporibus, conveniant, desiderat. Adeo ut mirum minime sit si fabula Protei ad viros prudentes transferatur; qui ab occasionibus constricti in omnes formas se vertunt, donec liberi ad naturas suas redeant. Atque sane admirabilis est species viri vere politici, in quo nil absonum, nil neglectum, nil stupidum, nil impotens, reperire liceat; sed qui sibi, cæteris, rebus, temporibus, debita tribuens, et negotiorum principia, media, clausu-

[1] Additional MSS. 4258, fo. 223. This fragment begins at the top of a page, without anything to show how much is missing. It is evidently the conclusion of a *Cogitatio de Prudentiâ civili*; and appears to commence in the middle of a discussion concerning the difficulty of civil as compared with moral wisdom.

las, periodos, distinguens, singula cum delectu faciat. Perfectissimus autem animi status, si sanitas affectuum accedat et boni fines. Qui autem ex philosophiæ disciplina civilibus rebus abstinent, aut in iisdem [se] versantes tam multa devitant ut actionum magnitudinem destruant; ii omnino similes sunt iis qui ut valetudinem conservent corporibus suis vix utuntur, et maximam temporis partem eorum curæ impendunt. Itaque ista, *non frui ut non cupias, non cupere ut non metuas*, quædam animi augustiæ sunt; et major est virtus quæ se sustinet quam quæ se cohibet.

De Quanto Materiæ certo et quod[1] *mutatio fiat absque interitu.*

[See *Cogitationes de Rerum Naturâ*, § v. This is not numbered; and the word *Cogitatio* has been written in the margin by the transcriber, as if it had not been in the original.]

Cogitatio 7ª.

De Consensu Corporum quæ sensu prædita sunt, et quæ sensu carent.

[See *Cogitationes de Rerum Naturâ*, § vii.]

Cogitatio 6ª.

De Quiete apparente et consistentia et fluore.

[See *Cogitationes de Rerum Naturâ*, § vi.

The concluding sentence of this Cogitatio is not found in Gruter's copy. In this transcript it closes a paragraph and comes to the bottom of the leaf;

[1] *quæ* in MS.

making it doubtful whether the original ended here or not. It is to be observed that the numbers of the last two Cogitationes are out of order, and coincide with those in Gruter. It may be therefore that they were not in the original, but inserted by way of reference.]

END OF VOL. V.

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